MAMMOET

Manual

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Client **Ralph L. Wadsworth Construction Co.**
Project **S.L.C. Bridge Replacement 4500s @ I-215**
Subject **Jacking/Transport Operation**

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1 Introduction

1.1 Introduction of this manual

The purpose of this document is to provide engineering and planning data to enable the safe and efficient removal and installation of the existing and new bridge segments and to verify that all reasonable considerations have been taken. The Replacement Operation is the responsibility of the fabricator who will sublet key elements of the work to Mammoet. This document has been originated by Mammoet and refers essentially to their work scope.

1.1.1 General information

4500s @ I-215 Bridge Replacement

Ralph L. Wadsworth Construction Co.Ralph L. Wadsworth Construction Co. (Wadsco) has appointed MAMMOET as Jacking/Transport Operation contractor for the above-mentioned Bridge Section.

COMPANY INFORMATION

Ralph L. Wadsworth Construction Co.

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Telephone Number:	801-553-1661
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Contact person contract:	Ralph Wadsworth
Project Manager:	Wayne Bowden

Mammoet U.S.A.

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Project Manager:	Carlos Jaimes
Engineering Manager:	Jack Tol

1.1.2 Summary

The bridge replacement operation will be carried out by means of *Self Propelled Modular Transporters (SPMT)*. The date of the bridge replacement operation is anticipated to commence on:

– October 26th, 2007

1.1.3 Bridge Sections Details

The Existing Bridge Sections are estimated to weigh 775 Ton [1,550,000 lbs] and the New Bridge Section is estimated to weigh 1,550 Ton [3,100,000 lbs]. These weights are as supplied by Wadsco. The weights shown do not include the Transport equipment.

1.1.4 Transport Operations

SPMTs positioned as per the Mammoet drawings, will perform the Transport Operation of the Bridge Sections. All drawings and calculations are based on the weights specified above.

The proposed SPMT layouts allow for a small weight increase or centre of gravity shift within practical limits, without the relocation of the SPMT. To guarantee a suitable SPMT layout the transport configuration has been checked using an envelope of the centre point of gravity of 250 mm in all directions.

Should the module weight increase significantly or the nominal tolerances for centre of gravity shift be exceeded, the SPMT capacity would be affected. Solutions to any arising problems would be:

A) Increase number of axle lines
B) Relocate the SPMTs

Leading up to the actual Replacement Operation the weight will be monitored by Wadsco, with any weight trends / changes being advised to Mammoet. SPMT arrangements will only be modified if the forecasted weight exceeds capacity.

2 Scope of work

2.1 Summary of work scope MAMMOET

- The Jacking/Transport of the existing and new bridge sections from their current position to the final position on the staging area or road.
- The supply and assembly of support structures in order to support the bridge sections adequately during transport
- The securing of the bridge sections to the transport system.
- Supply supervision and experienced labor with expertise on this type of operations.
- SPMT and hydraulic jack operators

Supply of major equipment, including:

- 64 axle-lines of Self Propelled Modular Transporters (SPMT)
- 16 500te capacity hydraulic jacks for the installation of the new bridge section
- Hydraulic equipment, pumps, hoses, etc.
- Support steel on top of trailer (excluding containers)
- Chain and cable lashings as required

2.2 Summary of work scope WADSCO.

- Safety instruction / induction to Mammoet crew directly after their arrival at site
- Unloading of Mammoet equipment
- Supply of adequate staging areas and compaction of soil
- Traffic control and police assistance if necessary
- Sufficient clearance to bring the bridge sections in and out
- 20T to 90T crane with riggers and operators to handle Mammoet equipment
- One 10,000lb capacity forklift with telescopic boom
- One 20,000lb capacity forklift with telescopic boom
- Two (2) 40' man-lifts (telescopic arm style)
- Supply of 2 welders and flame cutters (gouging)
- Level loading supports under bridge beams
- Temporary staging piers (blocking) for offloading of existing bridge sections, as per Mammoet drawings
- Appropriate lighting during night time work hours or when needed
- Removal of street furniture where applicable
- 12 – 20' L x 8'W x 8'-6" H Containers for transportation purposes

3 Communications

3.1 Communication

During the jacking/transport operations, all communication with the skidding operation organization will go through the Wadsco Construction manager.

Communications between Wadsco and Mammoet will be via the construction manager of Wadsco who will have a radio on Mammoet's frequency.

Communications between Mammoet operators on site is normally by radio, unless there is local interference, on our nationally licensed frequencies. All other communication will be verbal; face to face or by mobile phone.

Communication between Mammoet operators will be in English. One of the below mentioned frequencies will be used during the operations. Mammoet radios are equipped with a "Tone Lock" which will reduce interference from other frequencies to a minimum.

- Frequency 1 - Transmit/receive 464.50000 MHz.
- Frequency 2 - Transmit/receive 464.55000 MHz.
- Frequency 3 - Transmit/receive 464.60000 MHz.
- Frequency 4 - Transmit/receive 464.70000 MHz.
- Frequency 5 - Transmit/receive 469.50000 MHz.
- Frequency 6 - Transmit/receive 469.55000 MHz.
- Frequency 7 - Transmit/receive 469.60000 MHz.
- Frequency 8 - Transmit/receive 469.70000 MHz.
- Call Sign – WPLR953

4 Site-data

4.1 Bridge Replacement Operation Location

The Wadsco construction site is located along 4500s intersecting with the Interstate 215 West Loop in Salt Lake City, Utah. The staging areas for all bridge sections are located on the west side of I-215.

4.2 Ground Pressure

The minimum allowable ground pressure on the roadways as well as on the staging areas shall be 2,000 psf. During the transport operation of the bridge sections, the SPMTs will run directly on the roadways and staging area grounds, SPMTS are designed to exert a maximum of 2,000 psf when fully loaded.

5 Bridge Replacement Operation Procedures

5.1 General Procedure

The necessary Mammoet equipment will arrive to site one or two weeks prior to the bridge replacement operation. The support structures (false-works) will be assembled and setup so that when the SPMT arrives, they can be self-loaded in the proper position onto the transporters deck. The assemblies for the existing sections will be built first and the assemblies for the new sections will be built second.

Once the SPMT arrive to site, they will need to be assembled in the configuration necessary for the removal of the old sections. The East Existing Bridge Segment will be removed first; it will be transported to its staging area and offloaded onto temporary blocking using the SPMT hydraulics. The West Existing Bridge Segment will follow.

Once both existing section have been removed and offloaded, the braces on the SPMT will be re-configured and setup for the transportation of the new bridge section.

Simultaneously, the ramp to bridge from the new bridge staging area and the north bound lane will be built. Once built the transport/installation operation will take place.

5.1.1 Preparation of Transport equipment

Following the arrival of the SPMT on site, Mammoet personnel will offload all trailers using site cranes and visually check their condition, identifying if there is any damage.

As the trailers are assembled all hydraulic connections are cleaned, as are electrical cable sockets and plugs in between trailers. During assembly the trailers have a self diagnosing test system which monitors trailer performance and reports errors if they occur, this "watchdog system" ensures that operating anomalies are easily and quickly traceable and rectified.

Before any operation each unit is checked for leaks and full functional operation. All valve settings and computer co-ordinates are input by the operator and checked by the site operations supervisor.

When all trailers are connected and positioned in the required locations there is a further check to ensure that full compatibility settings are correct to enable safe one-man control.

5.1.2 Preparations of SPMT arrangement

The following SPMT arrangement will be utilized for the Bridge Replacement Operation:

SPMT arrangement for Existing Bridge Segments;

- 2 sets of 16 axle-line double-wide SPMT trailers mechanically coupled according to drawing 0010023194-G03-02

SPMT arrangement for New Bridge Segments;

- 2 sets of 16 axle-line double-wide SPMT trailers mechanically coupled according to drawing 0010023194-G02-02

5.1.3 Loading and unloading using skid shoe hydraulics

The following general procedure applies for loading and unloading of any load:

- Place packing on top of trailers as required
- Position trailers underneath item as specified in drawings
- Hydraulically connect trailer banks for a 3 or 4 point suspension
- Jack up the from the barge using the following step by step operation.

The SPMT will then be raised in small increments, increasing the lift pressure in gradual steps until the has been released from the build supports / transport grillage. By carrying out this load transfer in small pressure increments, we can visually monitor the pick up procedure and report the condition of the SPMT and the to the transport supervisor at each stage.

5.1.4 Preparations of Bridge Section in turn

The removal / installing of all temporary supports, etc., will be carried out by Wadsco. The final weight and centre of gravity of the bridge sections will be updated and advised to Mammoet by Wadsco.

5.1.5 Site preparations

To ensure that the level tolerances of the trailers are not exceeded, a level control of the transport area will be performed. If necessary, sand/gravel will be laid along the trailing route. In general, the trailers may operate with level differences up to ±150 mm. Level variations exceeding this, may be accepted, depending on the trailer arrangement and the load on the trailers.

All obstacles in the trailer path will be removed by Wadsco. Before the start of the operations the area will be cordoned off, with access only granted to nominated personnel. The safety officer of Wadsco will be responsible for this action.

5.2 Weather conditions

Wadsco will establish a weather report prior to the skidding operation, in accordance with the jacking/transport requirements from Mammoet.

In general the trasnport operation shall not proceed unless a weather report forecasting suitable conditions for a minimum of twenty-four hours or three times the operation period whichever is the greatest, has been received. Prior to the start of the skidding operation, Wadsco and the warranty surveyor will be consulted regarding the decision whether to proceed with the operation or to postpone it due to weather conditions or other restrictions.

A maximum wind criteria for starting the Bridge Replacement Operation is proposed to be Wind-force 6 (Beaufort) and decreasing. Stability calculations have been based on these criteria. In addition, a minimum visibility of 100m is required.

Wind-force	Wind Speed	Wind Speed	Wind speed	Wind Speed	Pressure	Pressure
Beaufort	Knots	miles / h	Km / h	m / s	kg/m^2	Te/m^2
3	7 – 10	12,1	19.4	5,4	1,9	0,002
4	11 – 16	17,7	28.4	7,9	4,0	0,004
5	17 – 21	23,9	38.5	10,7	7,3	0,007
6	22 – 27	30,9	49.7	13,8	12,1	0,012
7	28 – 33	38,3	61.6	17,1	18,6	0,019
8	34 – 40	46,3	74.5	20,7	27,3	0,027
9	41 – 47	54,6	87.8	24,4	37,9	0,038
10	48 – 55	63,5	102.2	28,4	51,4	0,051
11	56 – 65	73,0	117.4	32,6	67,7	0,068
12	65 +					

5.3 Pre-movement checklist

In order to ensure that all operations are carried out in accordance with approved and engineered procedures, Mammoet personnel on site will complete a checklist as the equipment is assembled and tested. For this operation the following points will be checked:

- The trailer assembly is in accordance with transport drawings
- The trailer drive system is functioning in forward and reverse
- All steering functions are available and operable
- Trailer computer co-ordinates are input and verified
- The hydraulic lifting system is fully pressurized and leak tested
- Diesel levels in the power pack are adequate for the operation
- Hydraulic fluid in the reservoir tank is within operating limits
- Access under the load is suitable and the transport route is clear

In addition to the above checks, which are carried out before lifting the load, the following are verified:

- All operations personnel fully briefed on operating conditions
- Radios fully charged and working
- After lifting ensure that pressures are within safe limits
- Wadsco will be notified of readiness to move
- Local weather conditions checked, to ensure they are not going to cause danger to the load or operating personnel

If the above are found to be acceptable, along with the approval of all calculations and the method statement, Wadsco will issue a Certificate of Approval, allowing the skidding operation to commence.

TRANSPORT OPERATION CHECKLIST	**Sheet 1 of 2**
Mammoet job number	0010024194-P038
Client	Ralph L. Wadsworth Construction Co.
Location	Salt Lake City, UT / I-215 @ 4500s
Item reference	
Wadsco representative	Wayne Bowden
Marine warranty company	N/A
Estimated start time of operation	T.B.D.
Estimated completion time of operation	T.B.D.
Mammoet Jacking/Transport Operation key personnel	
Project manager	Carlos Jaimes
Site manager	
Operations manager	
Project Engineer	Jack Tol
SPMT/Jacking Superintendent	Dennis Theis
Existing Bridge Segment details	
Name	West/East Bridge Segment
Weight	775 Ton [1,550,000 lbs] each
Has weight been confirmed	N
Structural strength checked	Y (Wadsco)
New Bridge Segment details	
Name	New Span
Weight	1,550Ton [3,100,000 lbs]
Has weight been confirmed	N
Structural strength checked	Y
SPMT configuration	
Structural strength of transport system checked	Y
SPMT function checks carried out	
Transport layout in accordance with drawings	
All power packs refuelled	
Clear access under load	
Environmental data	
Wind restrictions	31 MPH
Weather forecast available	
Checked and signed for Mammoet	

TRANSPORT OPERATION CHECKLIST	**Sheet 2 of 2**
General conditions	
Transport path clear	
Transport path marked and clear	
Adequate lighting for operations	
Communication systems checked	
Are Local Authorities notified	
Toolbox briefing held	
Pre-transport meeting held	
Shim plates available	
Checked and signed for Mammoet	

5.4 SKIDDING PROCEDURE

Step by Step Procedure for Existing Bridge Segments

- Mobilize SPMT, false-work and support equipment to site on conventional road transport and unload using site cranes (capacity approximately 70 tonnes - maximum individual 55 weight tonnes).
- It should be noted that prior to the assembly and/or placement of any equipment, a pre-assembly meeting will be held at which all concerned parties and authorities will be present.
- Wadsco will arrange with the proper authorities to ensure that all road traffic is notified of proceedings via the local broadcasting system and arranges their traffic schedules accordingly.

The equipment will be brought into place using a crane (provided by client) and swinging it in onto the staging areas where the transport assemblies are to be put together. Other smaller equipment can be brought in by using a "zoom-boom" type forklift and placing on a designated set down area.

1. Setup jackstands (pipe supports) in the staging area in order to start building the falsework assemblies on top of them so that the SPMT can self-load at a later date.
2. Start with the falsework required for the existing east bridge segment.
3. Using site cranes and forklifts install 25' steel mats on top of jackstands
4. Attach Mammoet frames to 20' containers supplied by Wadsco using site cranes and forklifts.
5. Load container assembly on top of 25' mats, ensuring a layer of plywood is placed between all steel to steel surfaces.
6. Proceed to place the remaining steel mats and jackstands on top of the container assembly as needed per each individual falsework assembly.
7. Place wood blocking needed to lift existing bridge segments on the south side of the bridge, these will be installed once the trailer is on the south side of the bridge for clearance purposes.
8. Once the falsework for the east existing segment has been assembled, proceed with the assembly of the falsework for the new bridge segment referring to the appropriate drawings.
9. Make hydraulic connections for the 500te jacks and test functionality and proper operation.
10. Assemble trailers in the transport configuration, 2 trains of double 16 axle-line SPMT
11. Run tests and diagnostics on SPMTs.
12. Drive SPMT under the falsework for the east existing bridge segment
13. Install the appropriate trailer braces (2 total)
14. For existing sections drive SPMT to south side of bridge and install wood blocking in the proper locations
15. SPMT power-pack shall be towards the south
16. Once blocking has been installed, drive SPMT uphill until it is in the lift position under the bridge's girders
17. Check clearances to underside of the bridge section, and add or remove shimming as needed.
18. Using the SPMT hydraulic system, extend until the blocking is lightly touching the underside of the bridge girders.
19. Check communication equipment and obtain operational approval from Wadsco to continue jacking up.

20. Hold a second personnel meeting with all parties involved to go over the jacking operation that is about to commence.
21. Continue jacking by raising the hydraulic system until approximately half of the expected load is transferred onto the skid-shoes; this will be monitored by pressure gauge readings.
22. Once approximately half of the load has been transferred onto the SPMT, visually check trailer and falsework for proper loading and alignment.
23. Perform a complete check of all equipment for signs or evidence of stress.
24. Continue jacking in 100Te increments until the full load has been transferred onto the SPMT and the bridge section has been raised from the bents.
25. Check all securing equipment and make sure chains and cables are taught and falsework is still aligned
26. At this point the system is ready to transport the bridge section.
27. Ensure that the transport path is clear of obstructions for trailer and bridge section.
28. Transport will be monitored closely by the Mammoet superintendent and all Mammoet personnel
29. Each one of the monitoring personnel has the power to stop the skidding if they believe it is unsafe to continue the transport operation.
30. For the east segment, drive uphill until the SPMT is able to crab (drive side-ways) over to the west by turning the SPMT axles 90 degrees
31. Once on the west side (south-bound lane), the SPMT will drive downhill to the appropriate staging area
32. The SPMT will back into the staging area (90 degree turn to the west) into the staging area checking for clearance to the top of the blocking installed by Wadsco
33. The SPMT will be adjusted accordingly to clear the top of the blocking while driving down into the 2% slope of the staging area.
34. Once in the set down position, the SPMT will adjust so that the bridge's girders are laying flat in the north-south direction. Trailer will stroke up it's front end to approx. 1700mm and its back end (power-pack end) to approx. 1250mm.
35. In this position the remaining blocking will be installed by Wadsco to support the bridge section in it's current position.
36. Once blocking is in place, the SPMT will lower itself, transferring the full load of the bridge section onto the staging blocking.
37. Remove the necessary wood blocking from the top of the falsework in order for the trailer to drive out from underneath.
38. Reconfigure falsework for the transportation of the west existing section as per the appropriate drawings
39. Repeat steps 14 thru 29 for the west bridge segment
40. As soon as clearance with bents allows, travel east (sideways) approximately 8' in order to clear the new bridge segment
41. Drive trailer uphill to the staging area
42. Go past the staging area and then back into it by making a 90 degree turn to the west in reverse
43. Repeat steps 32 thru 37.

Step by Step Procedure for New Bridge Segment

1. Drive SPMT under already built falsework underneath the new bridge section
2. Build ramp bridging between the staging area and the north bound lane on I-215 according to Mammoet drawing 0010024194-G05-00 using site forklifts and cranes
3. Check for proper alignment of SPMTs and install the lattice braces between them.
4. Using SPMT hydraulics lift falsework from its temporary supports and ensure proper alignment with the bridge's push up points and the SPMT falsework, align if necessary
5. Remove the necessary wood blocking from the top of the falsework in order for the trailer to drive out from underneath.
6. Check clearances to underside of the bridge section, and add or remove shimming as needed.
7. Using the SPMT hydraulic system, extend until the blocking is lightly touching the underside of the bridge girders.
8. Check communication equipment and obtain operational approval from Wadsco to continue jacking up.
9. Hold a second personnel meeting with all parties involved to go over the jacking operation that is about to commence.
10. Continue jacking by raising the hydraulic system until approximately half of the expected load is transferred onto the skid-shoes; this will be monitored by pressure gauge readings.
11. Once approximately half of the load has been transferred onto the SPMT, visually check trailer and falsework for proper loading and alignment.
12. Perform a complete check of all equipment for signs or evidence of stress.
13. Continue jacking in 100Ton increments until the full load has been transferred onto the SPMT and the bridge section has been raised from the bents.
14. Check all securing equipment and make sure chains and cables are taught and falsework is still aligned
15. At this point the system is ready to transport the bridge section.
16. Ensure that the transport path is clear of obstructions for trailer and bridge section.
17. Transport will be monitored closely by the Mammoet superintendent and all Mammoet personnel
18. Each one of the monitoring personnel has the power to stop the skidding if they believe it is unsafe to continue the transport operation.
19. Drive SPMT east, the south trailer will drive on top of the ramp towards the north-bound lane and the north trailer will drive onto the south bound lane.
20. The south SPMT will gradually turn towards the north in the direction of travel until both SPMT trains are running north to south on I-215
21. During transport the trailers will be closely monitored and adjusted as required.
22. Both SPMTs will drive simultaneously south towards the bridges setting position
23. Once the bridge section is hovering over the appropriate location on the bents and Wadsco has verified its position, the bridge will be lowered using a combination of trailer and jacks hydraulics in 100ton increments until the full load is transferred onto the bents.
24. Continue lowering trailer until push up points are clear

25. Drive trailer towards the north from under the bridge section for removal of falsework and disassembly.

5.5 Termination of Jacking/Transport Operation criteria

Decisions on whether to postpone or terminate a transport operation may have to be taken at any time prior to a transport operation commencing or during the transport operation.

PRIOR TO TRANSPORT OPERATION COMMENCING

A Transport operation will be postponed if one of the following conditions applies:

- If any significant item of the transport equipment becomes defective
- If any data relating to the trailers is found to be significantly at variance with the loading calculations, drawings or transport operation procedures
- If the weather conditions are found to be significantly worse than those predicted.

AFTER TRANSPORT OPERATION HAS COMMENCED

There can be no absolute rules for determining at what stage a transport operation would be "aborted" or "continued with" following technical problems arising once the transport operation has commenced. In the event of a serious problem or delay occurring, then a joint decision, whether to proceed or pull back, would be taken by Ralph L. Wadsworth Construction Co. / Mammoet, based on the following general guide lines.

5.6 Abort procedure

Unlike conventional transport systems, which rely on external prime movers such as winches, tractor units, hydraulic jacks, etc., Mammoet's self propelled trailers are entirely self-contained regarding power supply. Details of the Mammoet self-contained power supply system is mentioned in other parts of this document, but can be summarized as follows:

Propulsion is obtained from hydrostatic motors, which are built in the axles along the length of the trailers, and each separate unit, which is either 4 or 6 lines long, has 2 or 4 motors fitted. Each motor is capable of a torque which, translated at ground level, is equal to a horizontal force of 5.5 tonnes and as such, each trailer unit can transmit a horizontal force of 22.0 tonnes.

Should a transmission fault occur in any individual drive unit, the drive can be disengaged simply, without removing any wheel or releasing any of the payload, by turning a screw, which is directly connected internally, and acts as a clutch to release the drive mechanism.

The power pack units, which are mounted at the rear of each trailer, supply a "constant" pressure to the hydrostatic drive units. In the case of a power pack failure, the remaining power packs have spare parts, which can be easily connected to the affected trailer, allowing the transport to proceed. Although pressure can be maintained, the flow rate available is reduced enabling total horizontal force available to be maintained by at a reduced travelling speed.

6 Equipment outline specifications

6.1 Self Propelled Modular Transporters

Technical specification for the SPMT to be used on this project:

Type: SPMT 2nd Generation.
Length: Distance between axle lines longitudinally 1.4 metres
Width: Width overall 2.43 metres (when in normal driving mode)
Height: 1.5 metres transport height plus/minus 30 cm
Self-Weight: Average 4.0 tonnes per axle line

Suspension: Suspensions by hydraulic rams operating at a maximum pressure of 250 bar. In the unlikely event of a hydraulic line failure under load, then each suspension ram has an instantaneously activated cut off valve that locks off each ram preventing any collapse of the trailer suspension systems.

Steering: Steering is by rack and pinion activated hydraulically and controlled by a computer which permits 360 degree steering capability on each axle. All axles are co-ordinated electronically enabling each trailer to move forwards, backwards, in a circle, sideways, diagonally or in a carousel about it's own centre line. Furthermore, computer control of steering and propulsion functions enables groups of trailers, even when in open configuration, to carry out the full range of manoeuvres whilst carrying a single load and all with one operator control.

Propulsion: Powered axles (generally 2 per 6 or 4 axle unit) have a hydrostatic transmission unit developing 60 kN tractive force axle. The unit operates with equal efficiency and speed forwards, sideways or in reverse. Maximum speed under load, under site conditions, is 3kms/hr and unloaded 10 kms/hr.

Braking: Braking by hydrostatic transmission units backed up by brakes with a capacity of 45.2kN/axle each.

Suspension: Hydraulics can be rationalised into 3 or 4-point suspension systems beneath the load, even where units are in open configuration. In both 3 and 4 point suspension modes, the operator has a constant visual display of all hydraulic pressures in suspension rams and can immediately carry out level adjustments to suit changing site cross falls.

Acceleration:		(Maximum figures)	(Normal figures)
	Longitudinal	5.0%	2.0% or less
	Lateral	2.5%	1.0% or less
	Vertical	Zero	Zero

7 Safety policies

The safety officer of Ralph L. Wadsworth Construction Co. will instruct Mammoet employees directly after coming on site. Mammoet employees will be made familiar with site regulations.

During Mammoet's operations, weighing, site-move and Jacking/Transport Operation the area will be restricted. People inside this restricted area will be Mammoet's employees or the employees of Ralph L. Wadsworth Construction Co. whom are directly involved with Mammoet operations.

Before each operation a toolbox meeting will be kept and the involved people will be instructed.

It is the policy of Mammoet USA that the safety and health of its employees and those of its Sub-contractors is of prime importance in all activities of the Company.

The policy is intended to minimise, and if possible, prevent, all avoidable accidents and hazards to health.

Mammoet USA, as employer, accepts that it is primarily responsible for the health and safety of it's employees and that it should prepare procedures for carrying out all activities in which it operates, as well as providing adequate supervision to ensure that safe procedures are correctly executed, however, Mammoet also expects it's employees to be responsible for their own actions and informs them regularly of the risks and dangers than can be met and expects them to be involved in the preparation of safe working procedures.

Mammoet will arrange for periodic visits to be made to all site establishments by the Mammoet Group Safety Officer. Notwithstanding these visits, all Mammoet employees are encouraged to think "safety" at all times and to notify management of any areas where safety procedures require improvement.

It is the policy of the Company that every employee must wear protective clothing as appropriate to the activity being carried out and that persistent refusal of the employee to do so is likely to result in dismissal.

To ensure that this policy is actively carried out, the Company accepts that it is responsible for instructing it's employees of safe procedures for carrying out all activities and to give further instruction if additional employees are recruited, or if the nature of activities change, or if the location of activities demand additional knowledge or regulations to be complied with.

In the event of an unsafe or dangerous occurrence taking place, (whether or not this causes injury) then this must be fully recorded, investigated and action taken to ensure that any repetition is avoided.

It is the policy of Mammoet that all levels of management are required to enforce this policy statement and that any examples of unsafe activities shall be notified and investigated by the Managing Director of the Company, who is ultimately responsible for safety within the group.

7.1 Equipment safety

Mammoet has a high record of safety established over many years of experience. The following additional features are incorporated into Mammoet's self-propelled modular transporters.

A single operator controls all steering and propulsion functions, even where trailers are in open configuration. Misunderstanding and poor co-ordination between operators cannot occur.

Steering is computer controlled, even where trailers are separated in open configuration. This prevents horizontal forces being induced into the structure even where complex turning manoeuvres are carried out.

Every suspension is fitted with a safety valve, which cuts off instantaneously in the event of hose failure and prevents suspension collapse.

Fully reversible hydrostatic motors enable 'pull back' to be carried out any stage, if site conditions demand.

Easily removable half shafts in power axles enable movement to continue in the unlikely event of power pack failure occurring during movement.

In the unprecedented situation of 2 power packs malfunctioning at the same time, then the spare ports on remaining power pack allow the connection of hydraulic power hoses to be fed to defective transporters allowing movement to continue (but at a slower speed).

The single operator has a continuous visual display of all suspension pressures, whether a 3 point or 4 point suspension system is in use.

All systems have a mechanical over-ride in the event of a serious malfunction of the electronic controls occurring.

The system has been in operation for over 10 years and has a proven record of performance.

Winch cables, which are notorious for inducing indeterminate loads on snatch blocks and pad eyes, are not required.

7.2 Mammoet standard site safety regulations

7.2.1 Introduction

Mammoet's objective connected to safety is to recognise and consider safety as an essential ingredient of good management and efficient workmanship. It is established on site as a matter of normal discipline.

It is the Company's policy to make all staff, supervisors and hourly paid staff fully aware of basic safety requirements.

7.2.2 Scope

This procedure applies to the management and supervision of Mammoet, together with its sub-contractors in terms of general safety.

PROJECT MANAGER

At all times it must be recognised that the Project Manager is the person who is directly responsible for the protection of the men/women in his charge, and that the responsibility is not lessened by the presence of a Safety Officer in the organization.

SUPERVISOR

Supervisors apply the safety rules and procedures. Instructing new employees and making random safety inspections in their areas of responsibility and taking prompt actions when deemed necessary.

SAFETY OFFICER (Ralph L. Wadsworth Construction Co.)

The safety officer is responsible for the overall safety during all operations. The safety officer will have a day-to-day responsibility to ensure that the health and safety arrangements are being applied effectively. He will also be responsible for the marking of the restricted area during the site-move and skidding operation.

7.2.3 Before work commences

- Arrange supplies of goggles, safety helmets and other protective equipment, which is deemed necessary.
- Consider site conditions, possible obstructions and other hazards, which may be detrimental to safety and welfare.
- Personnel should be made familiar with:
  - Location of Medical Centre (on site),
  - First Aid positions and Accident Book location,
  - Procedures to obtain emergency services,
  - Rules governing evacuation of site,
  - Fire drill procedure on site.
- To ensure MS and sub-contractor personnel attend all Wadsco induction courses accordingly.

7.2.4 *Whilst working on site*

- Ensure that health and safety regulations are observed, e.g. the wearing of protective clothing, boots, glasses, etc.
- Monitor the work of all personnel and stimulate their interest and involvement in safety.
- Periodically inspect equipment, statutory site records (if requested), notices and general tidiness.
- Good housekeeping is a watchword. Any untidy site is more likely to be unsafe.
- Investigate all accidents leading to injury, damage or loss.
- In the event of an accident, take any immediate action necessary to deal with the situation.
- Ensure only competent and authorised personnel use site plant and equipment.

7.2.5 *At completion of work*

- Ensure that any statutory records, which the Wadsco requires, are correctly completed and handed over.

7.2.6 *Employee's responsibility*

- Comply with all statutory regulations.
- Work in a safe manner.
- Report to your immediate supervisor all unsafe conditions that arise.
- Report all incidents that may lead to accidents or injury.
- Comply with all rules and regulations made by the Company or by the Wadsco with regard to safety on site.
- Co-operate with the management in accident investigation.
- Employees are encouraged to take part in all schemes, which promote an interest in safety.
- Keep working areas clean and tidy.
- Safety helmets must be worn at all times in construction areas.
- Make use of all safety equipment and protective clothing that is available where circumstances require it.
- Inspect your equipment prior to use, if faulty report to your supervisor immediately.
- Where a hazard has to be created, it is important that warning signs are displayed and action taken to prevent injury.
- If you damage plant or tackle, report it to your supervisor immediately. Damaged equipment leads to accidents.
- All injuries received during the course of your employment on site must be recorded in the Accident Prevention Book and reported to the company Safety Officer.

7.2.7 *Relation between Mammoet and sub-contractors*

- The sub-contractor manager is responsible to the Mammoet Safety Officer for the implementation of all safety rules and regulations connected with sub-contractors/suppliers.
- Sub-contractors staff assigned to site are required to ensure within their particular areas of responsibility that rules and regulations are observed.
- Sub-contractors managers are responsible for making available the information necessary to allow their employees to carry out their work safely.
- This is affected through training, job instruction and safety supervision.

- Protective clothing and equipment must be made readily available and instructions given concerning its use by sub-contractors.
- Mammoet management has the responsibility to ensure that sub-contractors receive all Wadsco safety rules relevant to their undertakings and issue directives necessary in accordance with Wadsco safe working procedures.
- Sub-contractors are required to ensure that their employees are properly trained, given all information relevant to the working environment.
- Sub-contractors shall fully comply with the Mammoet safety standards, instructions and safe working procedures and any additional safety information issued by the Wadsco.
- Sub-contractors must provide their employees with and ensure they are worn, whenever statutory or site regulations prescribe, the following minimum Viaduct Sections of personal protection equipment:
    - Safety helmets,
    - Safety boots,
    - Safety glasses.

7.2.8 Risk analysis and contingency plans

TRAILER RELATED RISKS:

1.1 Tyre failure
1.2 Axle failure
1.3 Suspension arm failure
1.4 Hydraulic suspension hose failure
1.5 Power pack failure
1.6 Engine/pump connecting bush shears
1.7 Electronic controls
1.8 Failure of trailer bed or connecting points
1.9 Lack of fuel or hydraulic oil

OPERATOR RELATED RISKS:

2.1 Set up incorrect valve systems
2.2 Wrongly configured electric/data coupling
2.3 Operating with travel height too high or too low
2.4 Operating out of level
2.5 Incorrect steering

ENVIRONMENT RELATED RISKS:

3.1 Ground failure en route
3.2 Damaging services en route
3.3 Height and width restrictions en route
3.4 Obstructions caused by "street or barge furniture" en route
3.5 Obstruction of emergency vehicles
3.6 Emergency evacuation
3.7 Bad weather
3.8 Oil spillage

LOAD RELATED RISKS:

4.1 Weight incorrectly described by client
4.2 Centre of gravity incorrectly advised
4.3 Saddle or transport beam failure

COMMUNICATION RELATED RISKS:

5.1 Communications failure
5.2 Misunderstandings

TRAILER RELATED RISKS

	RISK	PREVENTATIVE MEASURES	CONTINGENCY SOLUTIONS
1.1	Tyre failure	Drive slowly to avoid overheating Check for visual damage Check pressures regularly Inspect route for hazards before journey.	Spare wheels complete with tyres accompanying each journey Isolate affected axle by closing suspension valve, raise trailer using hydraulics of remaining axles then jack up affected wheel with 5t jack and change wheel Lower off on completion and reconnect axle into normal circuit.
1.2	Axle failure	Check for any distortion or "play" during routine maintenance.	If failure occurs before load leaves fabrication point, then set down load and replace affected parts If failure occurs during journey, then isolate affected axle hydraulically, raise axle into the elevated position and lock off using "lock off" pins. Complete journey on one less axle (using spare trailer capacity).
1.3	Suspension arm	Check for any distortion or "play" during routine maintenance.	If failure occurs before load leaves fabrication point, then set down load and replace affected parts If failure occurs during journey, then isolate affected axle hydraulically, raise axle into the elevated position and lock off using "lock off" pins. Complete journey on one less axle (using spare trailer capacity).
1.4	Hydraulic suspension hose failure	Visual inspection every time trailers are assembled. Hydraulic pressure tests (working against closed valves) to 270 bar, following assembly of trailers. Ensure wherever possible that 3-point suspension is used so that safe working pressures are maintained regardless of terrain.	If a flexible hose fails during an operation, pressure check valves on each suspension arm prevent the progressive collapse of the suspension system. It would be necessary to replace the hose prior to movement recommencing, as the normal axle pressure compensation would not take place.

1.5	Power pack failure	Configurations normally have 2 or more power packs. Each power pack has spare ports that allow hydraulic oil under pressure to be diverted to any defective power pack.	Power pack failure is dealt with by one of 3 methods Repair power pack with spares from container using mechanic always in attendance Replace complete power pack with spare unit. (Takes approx. 1 hour) Divert oil from "running" power pack to "defunct" power pack using spare hydraulic ports on each unit.
1.6	Engine/pump connecting bush shears	Change bush every 2000 hours of use. Minimise periods of full throttle.	Failure of the bush results in total loss of power from the affected power pack. Solution is to replace engine in total, or to share hydraulic oil from a "running" unit to defunct unit as in "Power Pack Failure" above.
1.7	Electronic controls	Test all systems each time trailer is assembled, prior to it being positioned under the load.	Self-diagnosis computers indicate fault area so that replacement circuit boards can be slotted in. Spare unit computers, head computers and control boxes are carried within spares container. Mechanical over-ride to all controls means unit can be made safe in the unlikely event of total electronic failure.
1.8	Failure of trailer bed or connecting points	Ensure regular inspection carried out to search out any deformation or other stressing of components.	Carry out moment distribution calculations for all moves to ensure bending moments are within trailer safe moment of resistance. Note deflections in trailer bed are as predicted after lifting, but before movement commences. If significant variance is noted, then set down and investigate prior to moving.
1.9	Lack of fuel or hydraulic oil	Ensure tanks full prior to each and every operation.	Refill from cans carried in support back up vehicle.

OPERATOR RELATED RISKS

	RISK	PREVENTATIVE MEASURES	CONTINGENCY SOLUTIONS
2.1	Set up incorrect valve systems	Supervisor to check set up after valves set, prior to lifting commencing	Check all functions prior to trailer being positioned, and again after positioning and jacking, prior to movement of supports and movement of vehicle.
2.2	Wrongly configured electric/data coupling	Supervisor to check set up after assembly, but before lift commenced. Check all functions work prior to trailer being positioned under load.	Computers will not permit movement to commence unless all other electronic functions are reporting "zero fault".
2.3	Operating with height too high or too low	Supervisor to check trailer is at mean bed height (1500) on flat plain, prior to movement commencing.	Supervisor to monitor and re-check bed height at intervals throughout the operation, and, in addition, whenever there is a sudden change of gradient or level.
2.4	Operating out of level	Supervisor and driver to monitor level and trim using optical aids. Driver to stop and seek clarification from supervisor if level or trim begin to exceed 1 degree.	Level up trailer whenever trim or cross fall exceeds 1 degree.
2.5	Incorrect steering	Ensure visually that steering functions work in all five modes before positioning trailer under load.	Computers ensure traction cannot take place unless steering is in alignment. "Observers" positioned at strategic points to monitor alignment visually.

ENVIRONMENT RELATED RISKS

	RISK	PREVENTATIVE MEASURES	CONTINGENCY SOLUTIONS
3.1	Ground failure en route	Check route with client. Check records of other loads using the same route.	For any local failure, stop movement immediately. Lock off affected axle/axles and stabilise trailer using remaining axles. Beam or plate out ground to rectify failure. Establish cause of failure prior to re-energising affected axles.
3.2	Damaging services en route	Check route for services with Client.	Notify owner of service if damage caused. In the case of escape of water or gas, stop vehicle, lock off valves, switch off power pack and evacuate area until service escape is made safe.
3.3	Height and width restriction en route	Thoroughly check all doors, gates, bridges and overhead cables to ensure adequate clearances.	Make use of variable height jacking of trailer and 360 degree steering to pass through "pinch points" en route.
3.4	Obstruction caused by 'street or barge furniture' en route	Thoroughly schedule all furniture removals in good time for removals to be affected. Re-check route one day before movement to ensure no late changes have occurred.	Ensure engineer is fully equipped with emergency phone numbers and mobile phone to call up utilities if unexpected problem arises.
3.5	Obstruction of emergency vehicles	For urban or even site journeys, ensure fire and ambulance services advised of journey. For out of town journeys, liase with Police only.	Use 360-degree steering facility to allow emergency vehicle to pass if unexpected emergency arises.
3.6	Emergency evacuation	Ensure crew fully briefed on procedures to be adopted if emergency evacuation is required.	Stop vehicle, lock off number 7 (axle) valves, switch off power pack and evacuate area in accordance with procedures.

3.7	Bad weather	Check forecast 48, 24 and 12 hours prior to work commencing. Establish with Client, any unacceptable weather conditions. Normally, only fog, ice, high winds or snow would justify postponement.	Finally check with Client and if weather conditions are borderline. Ensure load is well lit if working in darkness. If necessary, provide additional lighting, poor visibility makes load dangerous to others
3.8	Oil spillage from broken or damaged components	Ensure regular maintenance checks of hard and flexible piping Check condition of hoses before fitting on site.	Clean up any spillage using clean up kits from the on site container. Change hoses from spares in containers

LOAD RELATED RISKS

	RISK	PREVENTATIVE MEASURES	CONTINGENCY SOLUTIONS
4.1	Weight incorrectly described by client	During initial jack up operation, carefully monitor suspension pressures to ensure pressure is within normal operational limits.	If pressure is exceeded, lower off onto construction supports prior to movement commencing, and seek clarification. If doubt continues, then carry out independent weighing operation prior to continuing
4.2	Centre of gravity incorrectly advised	Ensure centre of gravity position is issued by Client and taken into account when loading the trailer.	Carefully monitor suspension pressures when initial jacking up takes place. If pressures are not within acceptable limits, lower off onto supports / ground before movement takes place. In conjunction with Client, relocate trailer under load to ensure actual centre of gravity properly located.
4.3	Saddle or transport beam failure	Calculate predicted loads into saddles/beams from analysis of trailer. Ensure saddles/beams are designed for inertia forces as well as static load.	Ensure hand held temporary packing material is available to enable temporary packing to be affective, if saddle/beam shows signs of distress.

COMMUNICATION RELATED RISKS

	RISK	PREVENTATIVE MEASURES	CONTINGENCY SOLUTIONS
5.1	Communications failure	Ensure that all personnel are fully briefed on all aspects of the operation and that each individual is assigned a specific task and operating location. Check radio systems are functioning correctly.	Use hand signals in case of radio failure.
5.2	Misunderstanding	Ensure that all personnel are fully briefed on all aspects of the operation and that each individual is assigned a specific task and operating location. Supervisor and Engineer to monitor actions of operators.	Stop movement and re-instruct operators.

8 Structural data

8.1 Weight

Design of Jacking/Transport Operation is based on the weights as provided in latest weight report of Ralph L. Wadsworth Construction Co.

8.2 Design capacity for SPMT

The maximum payload per axle line is 30 tonnes. Own weight of the trailers is 4 tonnes per axle line. Bending moment and shear forces of the trailers have been checked and are suitable for the transport of the bridge segments.

8.3 Clash check

Wadsco will perform a clash check with the position of the SPMT and the load in relation to any obstacle along the transport route.

9 Appendix B – Sketches and drawings

9.1 Documents Jacking/Transport Operation

Document	Date	Pgs.	Eng.	Rev.	Description
0010024914-G02	10/05/07	3	JT	01	Installation of new bridge section (3D)
0010024914-T13	10/06/07	4	JMD	00	New Bridge Transport arrangement
0010024914-T11	10/07/07		RL	00	East existing bridge transport arrangement
0010024914-T12	10/07/07		RL	00	West existing bridge transport arrangement
0010024914-G04	10/05/2007	2	CAJ	02	Elevations for staging of old bridge segments
0010024194-G05	10/07/07	1	JT	00	Bridge Ramp Arrangement detail
0010024194-G06	10/05/2007	2	CAJ	00	Wood blocking location details – existing
0010024914-G07	10/08/07	1	CAJ	00	Securing details for east side new bridge
0010024914-G08	10/08/07	2	CAJ	00	Securing details for west side new bridge
0010024914-S07	10/04/2007	2	CAJ	02	Contact blocking old sections – row A
0010024914-S08	10/04/2007	3	CAJ	02	Contact blocking old sections – row B
0010024914-S09	10/04/2007	2	CAJ	02	Contact blocking old sections – row C
0010024914-S10	10/04/2007	2	CAJ	02	Contact blocking old sections – row D
0010024914-S11	10/04/2007	1	CAJ	01	Contact blocking old sections – misc.
7000028167	10/09/07	1	JG	00	Intermediate jacking frame
7000028163	10/09/07	1	JG	00	Jacking Container Top Frame
7000026982	08/07/07	1	JG	00	Convent 50' Ramp
7000003066	10/09/07	1	JG	00	40' – w12X65 steel mat
7000003065	09/06/07	1	JG	00	25' – w12x65 steel mat
7000003037	10/09/07	1	JG	00	25' – w10x60 steel mat
7000003036	09/25/07	1	JG	00	15' – w12x65 steel mat
7000024927	05/09/07	1	JG	00	15' – s6x17.25 steel mat
7000003035	05/09/07	1	JG	00	15' – w10x60 steel mat
7000003030	09/06/07	1	JG	00	15' – w8x40 steel mat
7000024690	05/02/07	1	JG	00	4' jackstand
7000003080	10/09/07	1	JG	00	3'-4" Jackstand
7000003079	01/20/03	1	MKL	00	2' Jackstand
7000001070	01/18/03	1	MHR	00	600ton jack/skid-shoe
7000001069	01/18/03	1	MHR	00	Heavy skid-track details

10 Strength Calculations

10.1 Main particulars of new New Bridge Segment:

Dimensions:

Length:	172'-2"
Width:	82'-4"
Bridge Height:	10'
Bent Height:	varies from 16'-6" to 24'-3"

Weight:

Total bridge weight	1,550 Tons
USE	**1,600 Tons**

The highest loadings onto the transport equipment will be seen during the transportation of the new bridge section, where a 1,600 Ton load will be transported on 64 axle-lines; for the old bridge sections the same number of axle-lines will be used to carry a 775 Ton load.

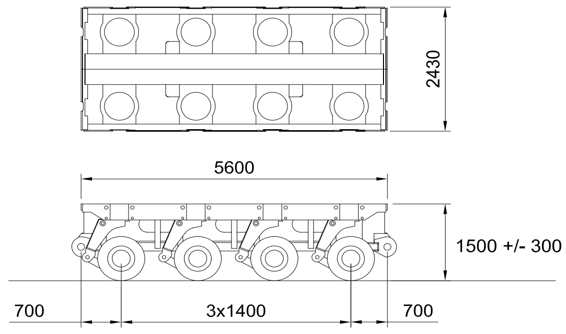
10.2 Additional Calculations

Document	Date	Pgs.	Eng.	Rev.	Description
0010024914-C01	10/05/07	14	KM	00	Container frame calc. new bridge
0010024914-C02	10/05/07	13	KM	00	Container frame calc. old bridge
0010024914-C03	10/06/07	5	CAJ	00	New bridge- blocking strength calculations
0010024914-C04	10/07/07	3	CAJ	00	New bridge – blocking securing/stability
0010024914-C05	10/06/07	18	JT	00	Old bridge – blocking strength and loadings
0010024914-C06	10/06/07	9	JT	00	Old bridge – blocking securing/stability

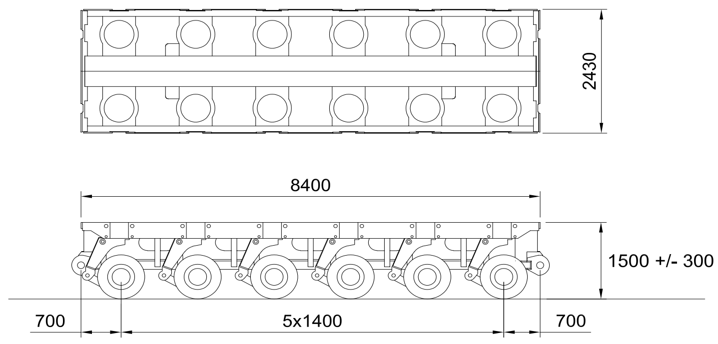
MAMMOET

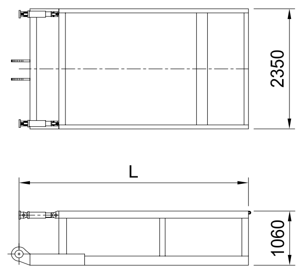
SCHEUERLE SPMT - '94

Trailer components

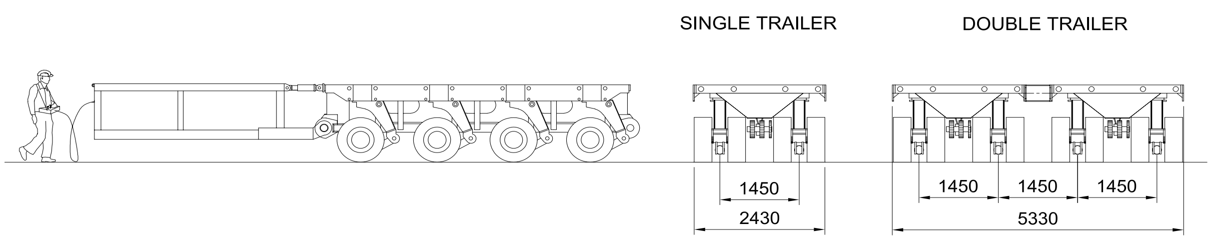


SPMT '94		
Specifications	**4 Lines**	**6 Lines**
Capacity	120	180
Weight:	16	24
Max. axleline load:	34	34
Pulling force:	-	-
Max. speed full load:	-	-



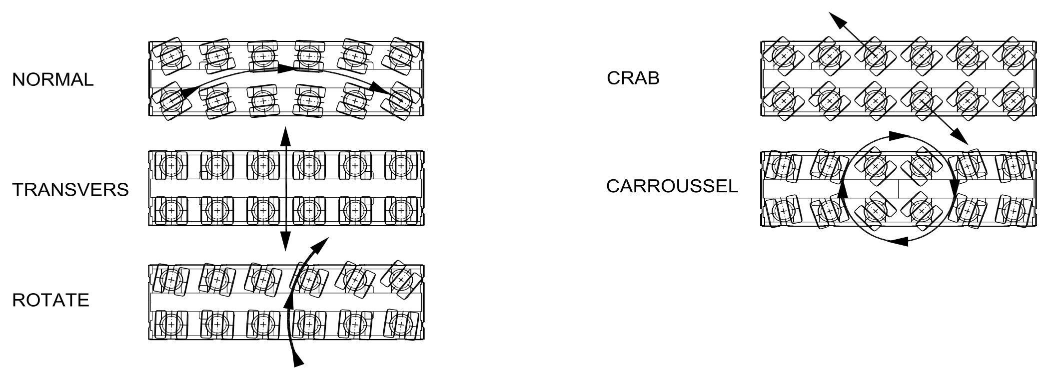


Powerpacks		
Capacity	**Length**	**Weight (kg)**
40 lines	4380	6700
40 lines	4200	6700
60 lines	5900	12000

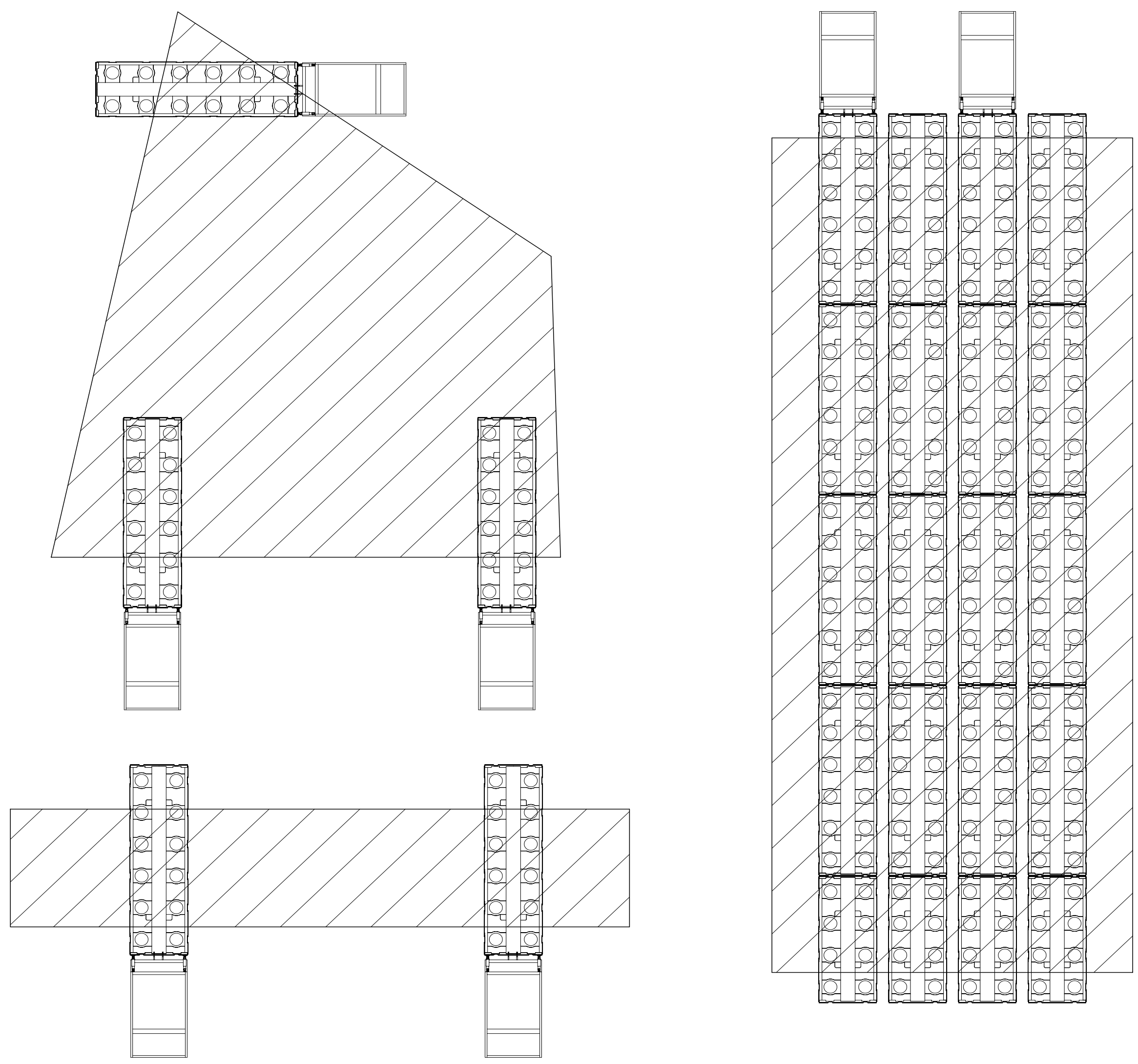


Capacities in metric tonnes depend on load case, dimensions in millimeters.
For reference only.

Steering capabilities



Combination examples



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Sap Nr.
Doc. Nr. 0010024914-W-C01
Status First issue

Client Ralph L. Wadsworth Contruction Co.
Project UT Bridge Section Installation at Salt Lake City Utah
Subject Calculation container and container frame loading and suitability

00	Calculation of Container and Frame Capacities	5/10/07	KM	JT	JT
Rev.	**Description**	**Date**	**Ref.**	**Checked**	**Approved**

Condition

MAMMOET

Client	Ralph L. Wadsworth Construction Co.	Sap Nr.		Page	2 of 4
Project	Salt Lake City UT Bridge Section Installation	Doc. Nr.	0010024914-W-C01	Date	5/10/07
Subject	Container and Frame Capacities	Ref.	KM	Rev.	00

Contents

1 Introduction

This report is part of the structural design calculation of the Mammoet container frames, as it will be used for the installation of the UT Bridge Section in Salt Lake city Utah.
This report gives the loading on the container frames and shows their suitability for the project at hand.
Three separate load cases have to be considered

(1) The actual gravity load from the bridge and all weights of the supporting equipment onto the container frames. See appendix A for the design calculations for the container frames.

(2) The 10 % lateral load onto the container frames and the containers. See ISO standard 1496-1 for container capacities. In general, a container has a lateral capacity of 150 KN. This project calls for four containers and associated frames which can resist a shear at the top of 600 KN. Using a safety of 10% bridge weight for a lateral load, we need to resist 80 tons on one side which is equivalent to 712 KN. The difference between 712 KN and 600 KN is 112 KN which will be resisted by 70 KSI transport chains in the longitudinal direction.

(3) The 10% transverse loading of the containers and frames. See ISO standard 1496-1 for capacities. The transverse loading a container and frame can withstand are 150 KN at each corner for a total of 300 KN. We have four units in this system which can resist a total of 1200 KN which combined with the resistance of the frame is sufficient to resist the 10% lateral loading.

1.1 Design criteria

The design and calculations of the container frame are according to the AISC Latest edition.

1.2 Loads

Loading onto the container frame

The dead load of the structure is calculated on the basis of a detailed material take down of the total structure including the bridge and the weights of the members carrying the bridge. In the computer calculation the dead load weight is generated by the computer program on the basis of the profiles / sections used in the computer model. The difference between the generated computer weight and the actual weight is accounted for with a weight correction factor.

2 Calculations

2.1-Computer model

The calculations are performed with the finite element software Esa PT release 7.0. Esa PT is a European computer program capable of calculating beams and plates.
In the calculation model all cross sections and materials are true to reality. Beams are represented as lines, being the neutral lines.

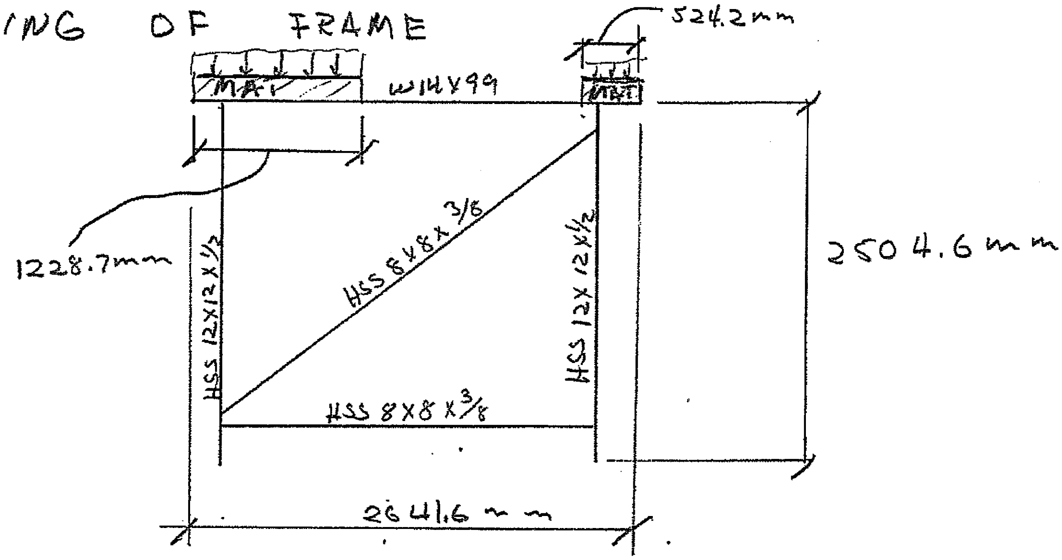
3 Appendices

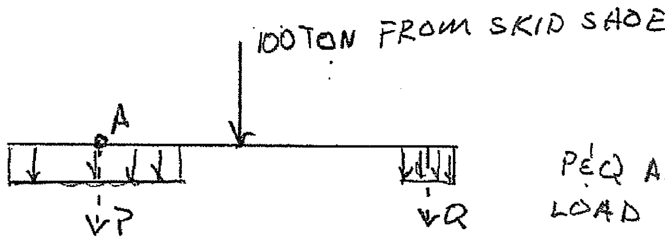
A. Esa PT design calculation documents

MAMMOET

Client: RALPH L. WADSWORTH CONSC.
Project: UT BRIDGE SECTION INSTALL
Subject: CONTAINER FRAME LOADING
SAP nr.:
Doc. nr.: JOB 24914
Ref.: KM
Page:
Date: 5/10/07
Rev.: 00

LOADING OF FRAME





P&Q ARE MATS LOAD ONTO FRAME

$+\circlearrowleft \Sigma M @ A = 0$

$= 100(706.44) - Q(1765.16)$

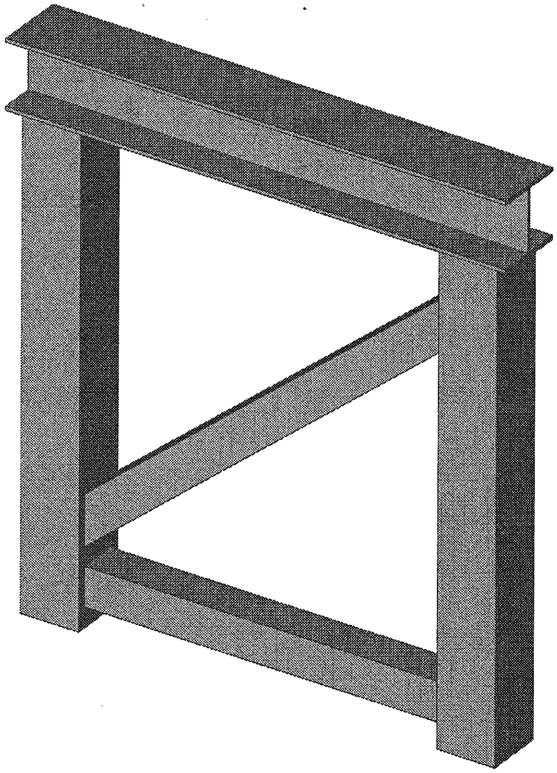
$Q = 40$ Ton

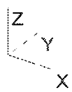
$P = 100 - 40 = 60$ Ton

Client:
Project:

MM 420-000

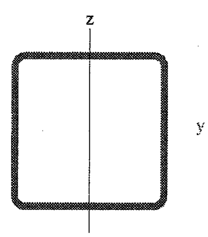
1. Top Container Frame





2. Geometry

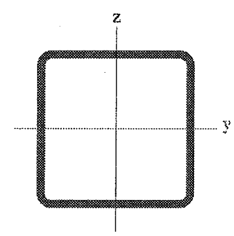
2.1. Cross-sections

>	**Name**	CS1	
	Type	HSS12X12X1/2	
	Source description	CD-ROM Database AISC Shapes Database / Version 3.0 / 2001	
	Type description	American rectangular & square hollow structural section - imperial naming convention	
	Material	grade 46	
	Fabrication	cold formed	
	Buckling y-y, z-z	c	c
>	**Picture**	 z y	
>	**Material**	grade 46	

>	A [ft²]	1.4531e-001	
	A y, z [ft²]	7.2656e-002	7.2656e-002
	I y, z [ft⁴]	2.2014e-002	2.2014e-002
	I t [ft⁴], w [ft⁶]	3.5106e-002	3.4836e-003
	alpha [deg]	0.00	
	Wel y, z [ft³]	4.4143e-002	4.4143e-002
	Wpl y, z [ft³]	5.5311e-002	5.5311e-002
	c YLCS, ZLCS [ft]	1	1
	d y, z [ft]	0	0
	AL [ft²/ft]	3.9012e+000	

>	Name	CS2	
	Type	HSS8X8X3/8	
	Source description	CD-ROM Database AISC Shapes Database / Version 3.0 / 2001	
	Type description	American rectangular & square hollow structural section - imperial naming convention	
	Material	grade 46	
	Fabrication	cold formed	
	Buckling y-y, z-z	c	c

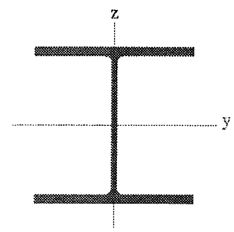
> Picture



>	Material	grade 46	
	A [ft²]	7.2011e-002	
	A y, z [ft²]	3.6005e-002	3.6005e-002
	I y, z [ft⁴]	4.7967e-003	4.7967e-003
	I t [ft⁴], w [ft⁶]	7.7048e-003	3.4036e-004
	alpha [deg]	0.00	
	Wel y, z [ft³]	1.4408e-002	1.4408e-002
	Wpl y, z [ft³]	1.8038e-002	1.8038e-002
	c YLCS, ZLCS [ft]	0	0
	d y, z [ft]	0	0
	AL [ft²/ft]	2.5882e+000	

>	Name	CS3	
	Type	W14X99	
	Source description	CD-ROM Database AISC Shapes Database / Version 3.0 / 2001	
	Type description	American wide flange beam - imperial naming convention	
	Material	A529 grade 50	
	Fabrication	rolled	
	Buckling y-y, z-z	b	c

> **Picture**



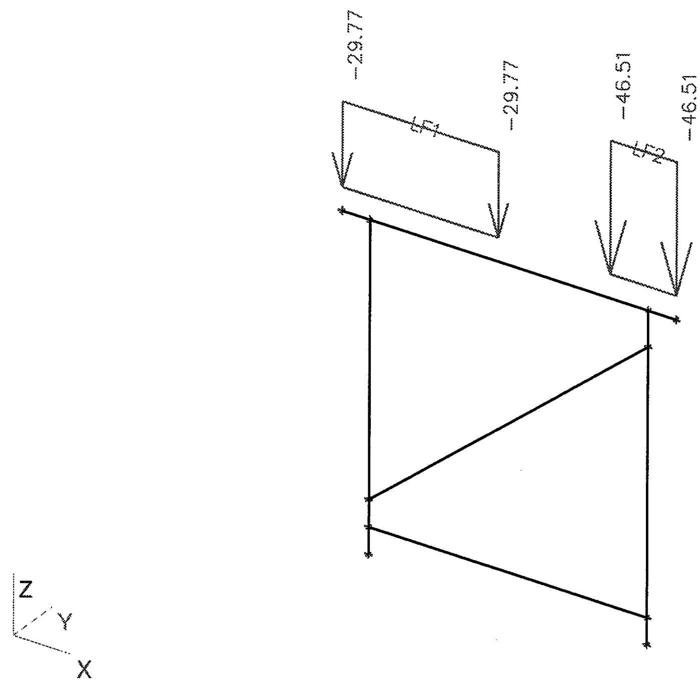
>	Material	A529 grade 50	
	A [ft²]	2.0236e-001	
	A y, z [ft²]	1.3195e-001	4.1065e-002
	I y, z [ft⁴]	5.3528e-002	1.9349e-002
	I t [ft⁴], w [ft⁶]	2.5837e-004	6.0111e-003
	alpha [deg]	0.00	
	Wel y, z [ft³]	9.0759e-002	3.1924e-002
	Wpl y, z [ft³]	1.0026e-001	4.8357e-002
	c YLCS, ZLCS [ft]	1	1
	d y, z [ft]	0	0
	AL [ft²/ft]	7.0515e+000	

3. Loading

3.1. Line forces on beam

Name	Member Load case	Type System	Dir Distribution	P1 [kip/ft]	x1 [ft] x2 [ft]	Coor Loc	Orig	Ecc ey [ft] Ecc ez [ft]
LF1	B3	Force	Z	-29.77	0.000	Abso	From start	0.000
	LC2	LCS	Uniform		4.031	Length		0.000
LF2	B3	Force	Z	-46.51	6.947	Abso	From start	0.000
	LC2	LCS	Uniform		8.667	Length		0.000

3.2. Gravity Loading



3.3. Calculation protocol

Calculation protocol.

Linear calculation

Number of 2D elements	0
Number of 1D elements	11
Number of mesh nodes	10
Number of equations	60
Loadcases	LC 1 LC1
	LC 2 LC2
Start of calculation	05.10.2007 02:48
End of calculation	05.10.2007 02:48

Sum of loads and reactions.

	[kN]	X	Y	Z
Loadcase 1	loads	0.0	0.0	-9.2
	reactions in nodes	0.0	0.0	9.2
	reactions on lines	0.0	0.0	0.0
	contact 1D	0.0	0.0	0.0
	contact 2D	0.0	0.0	0.0
Loadcase 2	loads	0.0	0.0	-889.6
	reactions in nodes	0.0	0.0	889.6
	reactions on lines	0.0	0.0	0.0
	contact 1D	0.0	0.0	0.0
	contact 2D	0.0	0.0	0.0

3.4. Load cases

Name	Action type	LoadGroup	Load type	Direction
LC2	Permanent	LG1	Standard	
LC1	Permanent	LG1	Self weight	-Z

3.5. Combinations

Name	Type	Load cases	Coeff. [1]
CO1	Envelope - ultimate	LC2	1.00

Name	Type	Load cases	Coeff. [1]
CO1	Envelope - ultimate	LC1	1.00

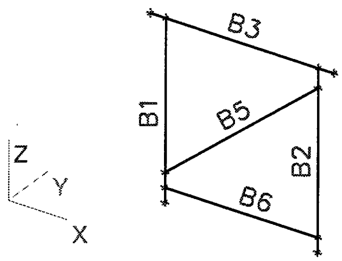
4. Results

4.1. Reactions

Linear calculation, Extreme : Global
Selection : All
Class : All ULS

Support	Case	Rx [kip]	Ry [kip]	Rz [kip]	Mx [kipft]	My [kipft]	Mz [kipft]
Sn2/N1	CO1/1	**-6.43**	0.00	**101.07**	0.00	0.00	0.00
Sn1/N3	CO1/1	**6.43**	**0.00**	100.99	**0.00**	**0.00**	**0.00**
Sn3/N4	CO1/1	0.00	0.00	**0.00**	0.00	0.00	0.00

4.2. Beam Labels



4.3. Internal forces on member

Linear calculation, Extreme : Member, System : Principal
Selection : All
Combinations : CO1

Member	Case	dx [ft]	N [kip]	Vy [kip]	Vz [kip]	Mx [kipft]	My [kipft]	Mz [kipft]
B1	CO1/1	1.349	**-103.67**	0.00	**-10.07**	0.00	**10.61**	0.00
B1	CO1/1	1.349	**-100.61**	0.00	-3.99	0.00	4.00	0.00
B1	CO1/1	0.000	-101.07	**0.00**	**6.43**	**0.00**	0.00	**0.00**
B1	CO1/1	8.217	-103.18	0.00	-10.07	0.00	**-58.54**	0.00
B2	CO1/1	0.667	**-101.05**	0.00	3.99	0.00	**-4.96**	0.00
B2	CO1/1	8.217	**-97.12**	0.00	10.07	0.00	**37.00**	0.00
B2	CO1/1	0.000	-100.99	**0.00**	**-6.43**	**0.00**	0.00	**0.00**
B2	CO1/1	7.327	-97.19	0.00	**10.07**	0.00	28.04	0.00
B3	CO1/1	0.724	**-10.07**	0.00	**81.59**	0.00	**-69.71**	0.00
B3	CO1/1	0.000	**0.00**	**0.00**	0.00	**0.00**	0.00	**0.00**
B3	CO1/1	7.942	-10.07	0.00	**-63.41**	0.00	-52.57	0.00
B3	CO1/1	3.302	-10.07	0.00	4.76	0.00	**41.57**	0.00
B5	CO1/1	0.000	**6.64**	**0.00**	**1.52**	**0.00**	**-6.61**	**0.00**
B5	CO1/1	9.372	**6.85**	0.00	**1.27**	0.00	**6.46**	0.00
B6	CO1/1	0.000	**10.41**	**0.00**	**-0.12**	**0.00**	**-0.68**	**0.00**
B6	CO1/1	7.218	10.41	0.00	**-0.37**	0.00	**-2.43**	0.00

4.4. Check of steel

Check of steel

AISC - ASD 2005 Check

Member B1	**HSS(Imp)12X12X1/2**	**grade 46**	**CO1/1**	**0.44**

Pu [kip]	Vux [kip]	Vuy [kip]	Mut [kipft]	Mux [kipft]	Muy [kipft]
-103.18	0.00	-10.07	0.00	-58.54	0.00

The critical check is on position 8.22 ft

Buckling parameters	xx	yy	
type	sway	non-sway	
Slenderness	43.62	21.11	
Reduced slenderness	0.55	0.27	
Length	6.87	8.22	ft
Buckling factor	2.47	1.00	
Buckling length	16.98	8.22	ft

LTB data		
Lb	8.22	ft
Cb	2.16	

Section is checked as compact section.

Check	
Compression	0.20 < 1
Bending strong axis	0.27 < 1
Shear	0.07 < 1
Combined stresses	0.44 < 1

AISC - ASD 2005 Check

Member B2	**HSS(Imp)12X12X1/2**	**grade 46**	**CO1/1**	**0.26**

Pu [kip]	Vux [kip]	Vuy [kip]	Mut [kipft]	Mux [kipft]	Muy [kipft]
-97.12	0.00	10.07	0.00	37.00	0.00

The critical check is on position 8.22 ft

Buckling parameters	xx	yy	
type	sway	non-sway	
Slenderness	12.23	21.11	
Reduced slenderness	0.15	0.27	
Length	0.89	8.22	ft

Buckling parameters	xx	yy	
Buckling factor	5.34	1.00	
Buckling length	4.76	8.22	ft

LTB data		
Lb	8.22	ft
Cb	2.57	

Section is checked as compact section.

Check	
Compression	0.17 < 1
Bending strong axis	0.17 < 1
Shear	0.07 < 1
Combined stresses	0.26 < 1

AISC - ASD 2005 Check

Member B3	HSS(Imp)8X8X3/8	grade 46	CO1/1	1.15

Pu [kip]	Vux [kip]	Vuy [kip]	Mut [kipft]	Mux [kipft]	Muy [kipft]
-10.07	0.00	81.59	0.00	-69.71	0.00

The critical check is on position 0.72 ft

Buckling parameters	xx	yy	
type	sway	non-sway	
Slenderness	33.58	33.58	
Reduced slenderness	0.43	0.43	
Length	8.67	8.67	ft
Buckling factor	1.00	1.00	
Buckling length	8.67	8.67	ft

LTB data		
Lb	8.67	ft
Cb	2.23	

Section is checked as compact section.

Check	
Compression	0.04 < 1
Bending strong axis	0.97 < 1
Shear	1.15 > 1
Combined stresses	0.99 < 1

AISC - ASD 2005 Check

Member B5	**HSS(Imp)8X8X3/8**	**grade 46**	**CO1/1**	**0.11**

Pu [kip]	Vux [kip]	Vuy [kip]	Mut [kipft]	Mux [kipft]	Muy [kipft]
6.64	0.00	1.52	0.00	-6.61	0.00

The critical check is on position 0.00 ft

LTB data		
Lb	9.37	ft
Cb	2.23	

Section is checked as compact section.

Check	
Tension	0.02 < 1
Bending strong axis	0.09 < 1
Shear	0.02 < 1
Combined stresses	0.11 < 1

AISC - ASD 2005 Check

Member B6	**HSS(Imp)8X8X3/8**	**grade 46**	**CO1/1**	**0.06**

Pu [kip]	Vux [kip]	Vuy [kip]	Mut [kipft]	Mux [kipft]	Muy [kipft]
10.41	0.00	-0.37	0.00	-2.43	0.00

The critical check is on position 7.22 ft

LTB data		
Lb	7.22	ft
Cb	1.54	

Section is checked as compact section.

Check	
Tension	0.04 < 1
Bending strong axis	0.03 < 1
Shear	0.01 < 1
Combined stresses	0.06 < 1

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Sap Nr.
Doc. Nr. 0010024914-W-C02
Status First issue

Client Ralph L. Wadsworth Construction Co.
Project UT Bridge Section Installation at Salt Lake City Utah
Subject Calculation container and container frame loading capacity for removal of the old bridge

00	Calculation of Container and Frame Capacities	5/10/07	KM	JT	JT
Rev.	**Description**	**Date**	**Ref.**	**Checked**	**Approved**

Condition

MAMMOET

Client	Ralph L. Wadsworth Construction Co.	Sap Nr.		Page	2 of 4
Project	Salt Lake City UT Bridge Section Installation Old Bridge Removal	Doc. Nr.	0010024914-W-C02	Date	5/10/07
Subject	Container and Frame Capacities	Ref.	KM	Rev.	00

Contents

Office *Mammoet USA - Rosharon*

Status

1 Introduction

This report is part of the structural design calculation of the Mammoet container frames, as it will be used for the removal of the old bridge for the UT Bridge Section installation project in Salt Lake city Utah.
This report gives the loading on the container frames and shows their suitability for the project at hand.
Three separate load cases have to be considered

(1) The actual gravity load from the bridge and all weights of the supporting equipment onto the container frames. See appendix A for the design calculations for the container frames.
(2) The 10 % lateral load onto the container frames and the containers. See ISO standard 1496-1 for container capacities. In general, a container has a lateral capacity of 150 KN. This project calls for four containers and associated frames which can resist a shear at the top of 600 KN or 135.1 kips. Using a safety of 10% bridge weight for a lateral load, we need to resist 150 kips. The difference between 150 kips and 135.1 kips is 14.9 kips which will be resisted by 70 KSI transport chains in the longitudinal direction.
(3) The 10% transverse loading of the containers and frames. See ISO standard 1496-1 for capacities. The transverse loading a container and frame can withstand are 150 KN at each corner for a total of 300 KN. We have four units in this system which can resist a total of 1200 KN which combined with the resistance of the frame is sufficient to resist the 10% lateral loading.

1.1 Design criteria

The design and calculations of the container frame are according to the AISC Latest edition.

1.2 Loads

Loading onto the container frame

The dead load of the structure is calculated on the basis of a detailed material take down of the total structure including the bridge and the weights of the members carrying the bridge. In the computer calculation the dead load weight is generated by the computer program on the basis of the profiles / sections used in the computer model. The difference between the generated computer weight and the actual weight is accounted for with a weight correction factor.

2 Calculations

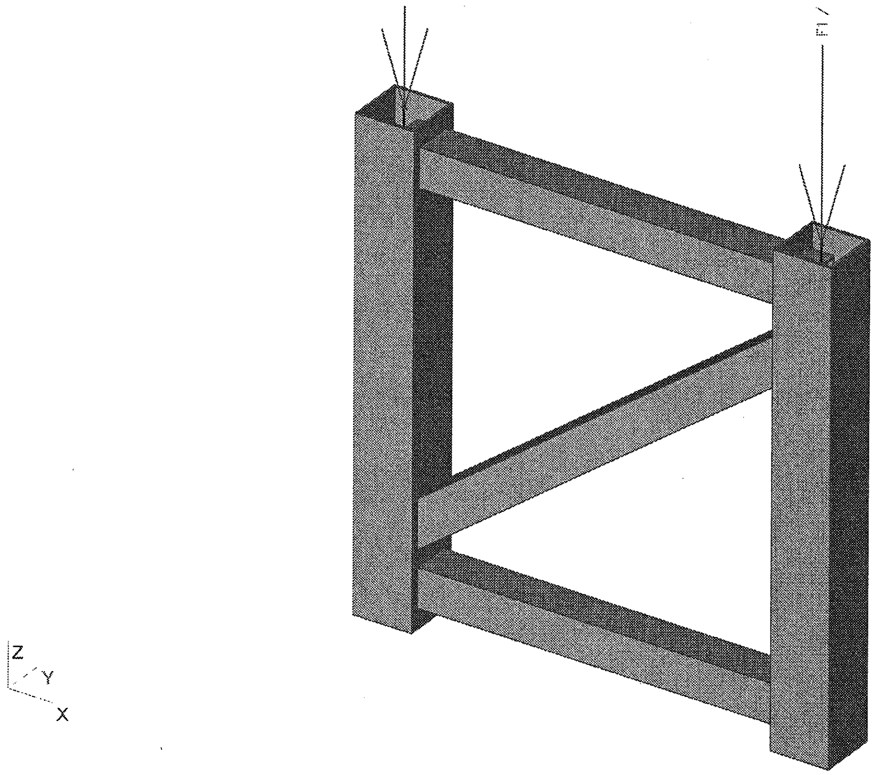
2.1-Computer model

The calculations are performed with the finite element software Esa PT release 7.0. Esa PT is a European computer program capable of calculating beams and plates.
In the calculation model all cross sections and materials are true to reality. Beams are represented as lines, being the neutral lines.

3 Appendices

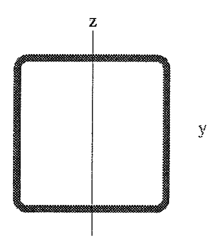
A. Esa PT design calculation documents

1. Top Container Frame



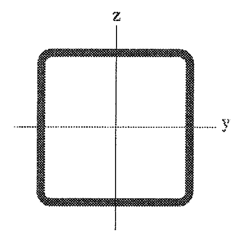
2. Geometry

2.1. Cross-sections

>	**Name**	CS1	
	Type	HSS12X12X1/2	
	Source description	CD-ROM Database AISC Shapes Database / Version 3.0 / 2001	
	Type description	American rectangular & square hollow structural section - imperial naming convention	
	Material	grade 46	
	Fabrication	cold formed	
	Buckling y-y, z-z	c	c
>	**Picture**		
>	**Material**	grade 46	

>	A [ft²]	1.4531e-001	
	A y, z [ft²]	7.2656e-002	7.2656e-002
	I y, z [ft⁴]	2.2014e-002	2.2014e-002
	I t [ft⁴], w [ft⁶]	3.5106e-002	3.4836e-003
	alpha [deg]	0.00	
	Wel y, z [ft³]	4.4143e-002	4.4143e-002
	Wpl y, z [ft³]	5.5311e-002	5.5311e-002
	c YLCS, ZLCS [ft]	1	1
	d y, z [ft]	0	0
	AL [ft²/ft]	3.9012e+000	

>	Name	CS2	
	Type	HSS8X8X3/8	
	Source description	CD-ROM Database AISC Shapes Database / Version 3.0 / 2001	
	Type description	American rectangular & square hollow structural section - imperial naming convention	
	Material	grade 46	
	Fabrication	cold formed	
	Buckling y-y, z-z	c	c
>	Picture		

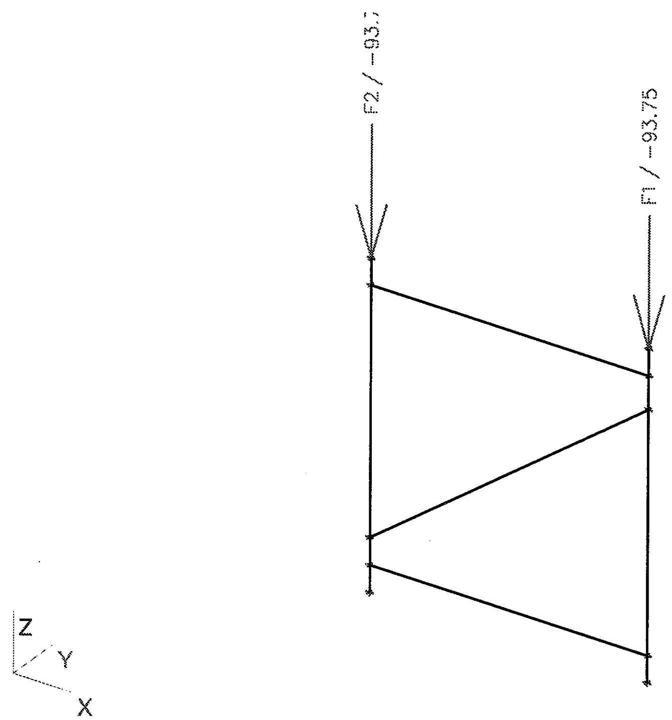


>	Material	grade 46	
	A [ft²]	7.2011e-002	
	A y, z [ft²]	3.6005e-002	3.6005e-002
	I y, z [ft⁴]	4.7967e-003	4.7967e-003
	I t [ft⁴], w [ft⁶]	7.7048e-003	3.4036e-004
	alpha [deg]	0.00	
	Wel y, z [ft³]	1.4408e-002	1.4408e-002
	Wpl y, z [ft³]	1.8038e-002	1.8038e-002
	c YLCS, ZLCS [ft]	0	0
	d y, z [ft]	0	0
	AL [ft²/ft]	2.5882e+000	

3. Loading

3.1. Line forces on beam

3.2. Gravity Loading



3.3. Calculation protocol

Calculation protocol.

Linear calculation

Number of 2D elements	0
Number of 1D elements	11
Number of mesh nodes	10
Number of equations	60
Loadcases	LC 1 LC1
	LC 2 LC2
Start of calculation	05.10.2007 04:44
End of calculation	05.10.2007 04:44

Sum of loads and reactions.

	[kN]	X	Y	Z
Loadcase 1	loads	0.0	0.0	-8.9
	reactions in nodes	0.0	0.0	8.9
	reactions on lines	0.0	0.0	0.0
	contact 1D	0.0	0.0	0.0
	contact 2D	0.0	0.0	0.0
Loadcase 2	loads	0.0	0.0	-834.0
	reactions in nodes	0.0	0.0	834.0
	reactions on lines	0.0	0.0	0.0
	contact 1D	0.0	0.0	0.0
	contact 2D	0.0	0.0	0.0

3.4. Load cases

Name	Action type	LoadGroup	Load type	Direction
LC2	Permanent	LG1	Standard	
LC1	Permanent	LG1	Self weight	-Z

3.5. Combinations

Name	Type	Load cases	Coeff. [1]
CO1	Envelope - ultimate	LC2	1.00

Name	Type	Load cases	Coeff. [1]
CO1	Envelope - ultimate	LC1	1.00

4. Results

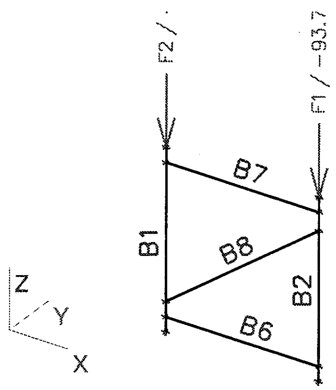
4.1. Reactions

Linear calculation, Extreme : Global
Selection : All
Class : All ULS

Support	Case	Rx [kip]	Ry [kip]	Rz [kip]	Mx [kipft]	My [kipft]	Mz [kipft]
Sn1/N3	CO1/1	**-0.16**	**0.00**	**94.75**	**0.00**	**0.00**	**0.00**
Sn2/N1	CO1/1	**0.16**	0.00	94.75	0.00	0.00	0.00
Sn3/N4	CO1/1	0.00	0.00	**0.00**	0.00	0.00	0.00

Project	Old Bridge Section Removal	**Description**	Intermediate Container Frame Gravity Loading	**Page**	5/9
		Author	Ken McVay	**Date**	04. 10. 2007

4.2. Beam Labels



4.3. Internal forces on member

Linear calculation, Extreme : Member, System : Principal
Selection : All
Combinations : CO1

Member	Case	dx [ft]	N [kip]	Vy [kip]	Vz [kip]	Mx [kipft]	My [kipft]	Mz [kipft]
B1	CO1/1	0.667	-94.93	0.00	-0.46	0.00	-1.20	0.00
B1	CO1/1	7.550	-93.59	0.00	0.34	0.00	1.09	0.00
B1	CO1/1	0.000	-94.75	0.00	-0.16	0.00	0.00	0.00
B1	CO1/1	1.349	-94.04	0.00	0.34	0.00	-1.00	0.00
B1	CO1/1	1.349	-94.88	0.00	-0.46	0.00	-1.52	0.00
B2	CO1/1	0.000	-94.75	0.00	0.16	0.00	0.00	0.00
B2	CO1/1	8.217	-93.75	0.00	0.00	0.00	0.00	0.00
B2	CO1/1	6.717	-94.32	0.00	-0.34	0.00	1.59	0.00
B2	CO1/1	0.667	-94.22	0.00	0.46	0.00	-1.33	0.00
B6	CO1/1	0.000	0.29	0.00	0.48	0.00	-1.44	0.00
B6	CO1/1	7.218	0.29	0.00	0.22	0.00	1.10	0.00
B7	CO1/1	0.000	0.34	0.00	-0.20	0.00	1.09	0.00
B7	CO1/1	7.218	0.34	0.00	-0.46	0.00	-1.31	0.00
B8	CO1/1	0.000	-1.14	0.00	0.20	0.00	-0.52	0.00
B8	CO1/1	8.995	-0.95	0.00	-0.05	0.00	0.16	0.00
B8	CO1/1	6.996	-0.99	0.00	0.00	0.00	0.21	0.00

4.4. Check of steel

· Check of steel

AISC - ASD 2005 Check

Member B1	**HSS(Imp)12X12X1/2**	**grade 46**	**CO1/1**	**0.20**

Pu [kip]	Vux [kip]	Vuy [kip]	Mut [kipft]	Mux [kipft]	Muy [kipft]
-94.04	0.00	0.34	0.00	-1.00	0.00

The critical check is on position 1.35 ft

Buckling parameters	xx	yy	
type	sway	non-sway	
Slenderness	54.89	21.11	
Reduced slenderness	0.70	0.27	
Length	6.87	8.22	ft
Buckling factor	3.11	1.00	
Buckling length	21.36	8.22	ft

LTB data		
Lb	8.22	ft
Cb	2.09	

Section is checked as compact section.

Check	
Compression	0.20 < 1
Bending strong axis	0.00 < 1
Shear	0.00 < 1
Combined stresses	0.10 < 1

AISC - ASD 2005 Check

Member B2 | HSS(Imp)12X12X1/2 | grade 46 | CO1/1 | 0.22

Pu [kip]	Vux [kip]	Vuy [kip]	Mut [kipft]	Mux [kipft]	Muy [kipft]
-94.32	0.00	-0.34	0.00	1.59	0.00

The critical check is on position 6.72 ft

Buckling parameters	xx	yy	
type	sway	non-sway	
Slenderness	61.68	21.11	
Reduced slenderness	0.78	0.27	
Length	7.55	8.22	ft

Buckling parameters	xx	yy	
Buckling factor	3.18	1.00	
Buckling length	24.01	8.22	ft

LTB data		
Lb	8.22	ft
Cb	1.71	

Section is checked as compact section.

Check	
Compression	0.21 < 1
Bending strong axis	0.01 < 1
Shear	0.00 < 1
Combined stresses	0.22 < 1

AISC - ASD 2005 Check

Member B6	HSS(Imp)8X8X3/8	grade 46	CO1/1	0.02

Pu [kip]	Vux [kip]	Vuy [kip]	Mut [kipft]	Mux [kipft]	Muy [kipft]
0.29	0.00	0.48	0.00	-1.44	0.00

The critical check is on position 0.00 ft

LTB data		
Lb	7.22	ft
Cb	2.36	

Section is checked as compact section.

Check	
Tension	0.00 < 1
Bending strong axis	0.02 < 1
Shear	0.01 < 1
Combined stresses	0.02 < 1

AISC - ASD 2005 Check

Member B7	HSS(Imp)8X8X3/8	grade 46	CO1/1	0.02

Pu [kip]	Vux [kip]	Vuy [kip]	Mut [kipft]	Mux [kipft]	Muy [kipft]
0.34	0.00	-0.46	0.00	-1.31	0.00

The critical check is on position 7.22 ft

LTB data		
Lb	7.22	ft
Cb	2.22	

Section is checked as compact section.

Check	
Tension	0.00 < 1
Bending strong axis	0.02 < 1
Shear	0.01 < 1
Combined stresses	0.02 < 1

AISC - ASD 2005 Check

Member B8	**HSS(Imp)8X8X3/8**	**grade 46**	**CO1/1**	**0.01**

Pu [kip]	Vux [kip]	Vuy [kip]	Mut [kipft]	Mux [kipft]	Muy [kipft]
-1.14	0.00	0.20	0.00	-0.52	0.00

The critical check is on position 0.00 ft

Buckling parameters	xx	yy	
type	sway	non-sway	
Slenderness	48.88	26.15	
Reduced slenderness	0.62	0.33	
Length	9.00	9.00	ft
Buckling factor	1.40	0.75	
Buckling length	12.62	6.75	ft

LTB data		
Lb	9.00	ft
Cb	2.36	

Section is checked as compact section.

Check	
Compression	0.00 < 1
Bending strong axis	0.01 < 1
Shear	0.00 < 1
Combined stresses	0.01 < 1

STRENGTH CALCULATIONS FOR FALSEWORK EQUIPMENT

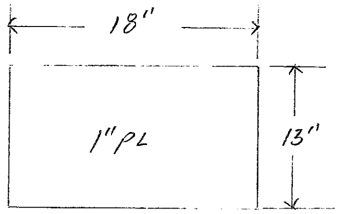
NEW BRIDGE (EAST TRAILER, NORTH BOUND LANE)

TOTAL BRIDGE WEIGHT = 3,100 Kip

Load per 600Te Jack = 200 Kip
+10% Contingency = 20 Kip

USE = 220 Kip [99.8Te]

Load on top level beams = 220 Kip at 2 lift plates
= 110 Kip per lift plate



LIFT PLATE

$A = 234\ in^2$

On 8" Mats plate catches 3 beams (W8x40)

Check web crippling

$$R = 67.5 t_w^2 \left[1 + 3\left(\frac{N}{d}\right)\left(\frac{t_w}{t_f}\right)^{1.5}\right]\sqrt{F_{yw}\, t_f / t_w}$$

$t_w = 0.360$ in
$N = 13$ in
$d = 8.25$ in
$t_f = 0.560$ in
$F_{yw} = 50$ Ksi

$$R = 67.5(0.360)^2\left[1 + 3\left(\frac{13}{8.25}\right)\left(\frac{0.360}{0.560}\right)^{1.5}\right]\sqrt{(50)(0.560/0.360)}$$

$R = 8.748 [3.436] 8.819$

$R = 265$ Kip allowable per beam

X 3 beams = 795 Kip

795 Kip > 110 Kip OK

Web yielding on W8X40

Max. interior load, Kips = $0.66 F_{yw} t_w (N + 5k)$

$= 0.66 (50 ksi)(0.360)(13 in + 5(1.0625))$

$= 217.5$ Kips

$\times$ 3 beams = 652.7 Kip

652.7 Kip > 110 Kip ✓

CHECK WEB CRIPPLING ON W12X65 MATS

$t_w = 0.390 in$
$N = 13 in$
$d = 12.12 in$
$t_f = 0.605 in$
$F_{yw} = 50 ksi$

$R = 67.5(0.390)^2 \left[1 + 3\left(\frac{13}{12.12}\right)\left(\frac{0.390}{0.605}\right)^{1.5}\right]\sqrt{(50)(0.605/0.390)}$

$R = 10.26 [2.66] 8.81$

$R = 240$ Kip $\times$ 2 beams = 480 Kip

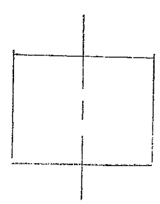
480 Kip > 110 Kip ✓

WEB YIELDING $= 0.66 (50 ksi)(0.390)(13 + 5(1.3125))$

$= 251.76$ Kip $\times$ 2 beams = 503.52 Kip

503.52 Kip > 110 Kip ✓

LOAD ON 2' JACKSTANDS = 110 Kip



Pipe cross section

$A = 14.03 in^2$

$I = 994.3 in^4$

$r = 8.42 in$

$D = 24 in$
$d = 23.625 in$
$L = 2'$
$K = 0.65$

Short Column

$$P_{cr} = A s_y \left[1 - \frac{s_y (KL/r)^2}{4\pi^2 E} \right]$$

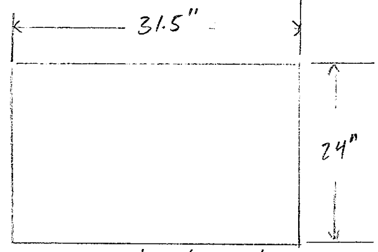
$$P_{cr} = (14.63)(50)\left[1 - \frac{50\,(15.6/8.42)^2}{4\pi^2(30\times10^6)} \right]$$

$P_{cr} = 701.49$ Kip

701.49 Kip > 110 Kip ok

LOAD ONTO 12" MATS (W12X65) by 600 T JACKS.

LOAD = 220 Kip



600te Jack Plate

$$R = 67.5\,(0.390)^2\left[1 + 3\left(\frac{31.5}{12.12}\right)\left(\frac{0.390}{0.605}\right)^{1.5}\right]\sqrt{50\,(0.665/0.390)}$$

$R = 10.26\,[5.035]\,8.81$

$R = 455.1$ Kip

Plate catches 3 beams = 1,365 Kip > 220 Kip ok

WEST TRAILER (South Bound Lane)

Load onto 6" mats by Lift plates = 110 Kips p/plate

Check web crippling on S6 x 17.25 beams

$t_w = 0.465$
$N = 13$ in
$d = 6$ in
$t_f = 0.359$
F_{yw} 50 ksi
$k = 0.875$ in

Lift plate (18") catches 5 beams

$R = 67.5(0.465)^2\left[1+3\left(\frac{13}{6}\right)\left(\frac{0.465}{0.359}\right)^{1.5}\right]\sqrt{(50)(0.359/0.465)}$

$R = 14.6\,[10.58]\,6.21$

$R = 959.7$ Kip per beam

959.7 x 5 beams = 4,798 Kips > 220 Kip ok

CHECK WEB YIELDING $= 0.66(50\text{ ksi})(0.465)[13+5(0.875)]$

$= 266$ Kip x 5 beams = 1,333 Kip

1,333 Kip > 220 Kip ok

LOAD FROM 600T JAKS ONTO W24X131 MATS

$t_w = 0.605$ in
$N = 24$ in
$d = 24.48$ in
$t_f = 0.960$ in
$F_{yw} = 50$ ksi
$k = 1.75$ in

JACKING Plate catches 2 beams

$R = 67.5(0.605)^2\left[1+3\left(\frac{24}{24.48}\right)\left(\frac{0.605}{0.960}\right)^{1.5}\right]\sqrt{50\left(\frac{0.960}{0.605}\right)}$

$R = 24.7\,[2.47]\,8.90$

R = 543 Kip x 2 beams = 1,086 Kip

1,086 Kip > 220 Kip OK

CHECK WEB YIELDING

= 0.66 (50 Ksi)(0.605)[24in + 5(1.75)]

= 653 Kip x 2 = 1,307 Kip

1,307 Kip > 220 Kip

Client: R.L. Wadsworth SAP nr.: 0010024914 - C04 Page: 1
Project: 4500s @ I-215 Doc nr.: Date: 10.7.07
Subject: Securing Calculations new bridge Ref.: Rev.: 00

NEW BRIDGE BLOCKING SECURING

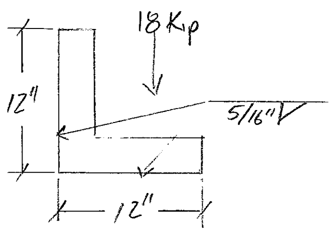
- Stability over longitudinal direction (travel direction)
  Max side load is caused by 4% slope on the road, an additional impact factor of 5% will be used as safety factor.

BRIDGE WEIGHT = 1,600 Ton = 3,200 Kip = 14,234 KN

Total load in longitudinal direction = (0.04 + 0.05)(14,234 KN)
= 1,281 KN ≙ 288 Kip

LOAD IS DIVIDED ONTO 16 hydraulic jacks
288 Kip / 16 = 18 Kip per jack.

First contact point is Bridge's lifting plate to "L" Plates (Refer to dwgs. 0010024914-G07 & G08)



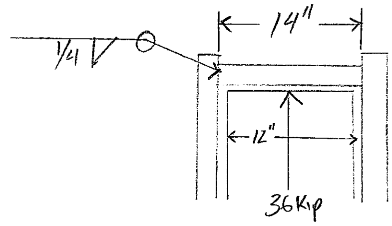
5/16" fillet weld = 4.64 Kip / linear inch
4.64 x 12 = 55.68 Kip
55.68 Kip > 18 Kip ✓

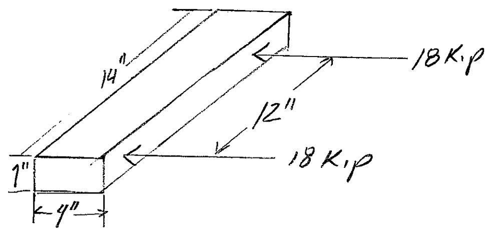
NEXT LEVEL DOWN STEEL MATS ARE SECURED BY A 1/4" FILLET WELD 6" at 10" CENTERS, only 8 JACKS Have SECURED SKIDTRACKS. MAX LOAD = 36 Kip
Amount of 6" length welds = 3
= 3 x 6" = 18" of WELD

1/4" fillet weld = 3.71 Kip / Linear inch
18" x 3.71 = 66.78 Kip
66.78 Kip > 36 Kip ✓

Jackstands are secured to skidtrack the same way, a 1/4" fillet weld - 6" at 10" centers

On the east side rear assembly, Jackstands are secured to skidshoe by a Locking flat bar assembly. (dwg. 514)





Bending in 1" flat bar $\qquad S_x = b\,h^2/6 = 2.66\,in^3$

$M_{max} = 18 + (3 \times 18) = 72$ Kip·in

$F_b = 72/S_x = 72/2.66 = 27$ Ksi

$UC = 27/(50\,Ksi \times 0.66) = 0.81$ ✓ ok

Shear strenght

$A = 4\,in^2$

$T = F/A = 18\,Kip/4 = 4.5$ Ksi

$UC = 4.5/33 = 0.14$ ✓ ok

Weld strenght

1/4" Fillet weld = 3.71 Kip/linear inch

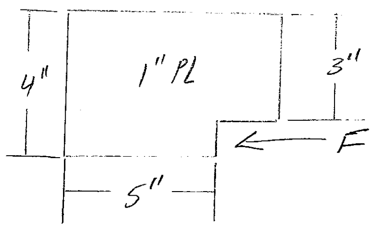
= 3.71 Kip × 10" = 37.1 Kip

37.1 Kip > 18 Kip ✓ ok

The same size flat bar and weld is used for securing mats to skidshoe and also for skidtracks to skidshoes.

Client: R.L Wadsworth | SAP nr.: 0010024914 - C04 | Page: 3
Project: 4500 s @ I-215 | Doc nr.: | Date: 10·7-07
Subject: | Ref.: | Rev.: 00

Securing of skidshoes to steel Mats



Max longitudinal load = 36 Kip

Check shear

Shear area = 5 in x 1 in = 5 in^2

$T = F/A = 36{,}000/5 = 7{,}200$ psi

$UC = 7.2/33 = 0.22$ ✓

5/16" Fillet weld = 10" x 4.64 Kip = 46.4 Kip

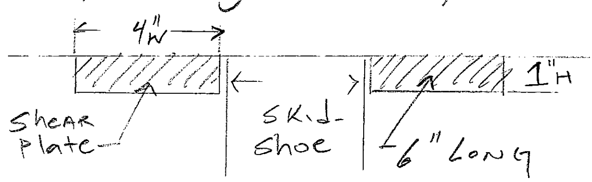
46.4 Kip > 36 Kip ✓

- STABILITY OVER TRANSVERSE DIRECTION

9% of load = 18 Kip per skidshoe

- Lifting plates, Jackstands and Mats are secured to each other by the welds and plates specified in the longitudinal direction securing.

Jackstands and mats are secured to skidtrack by using shear plates.



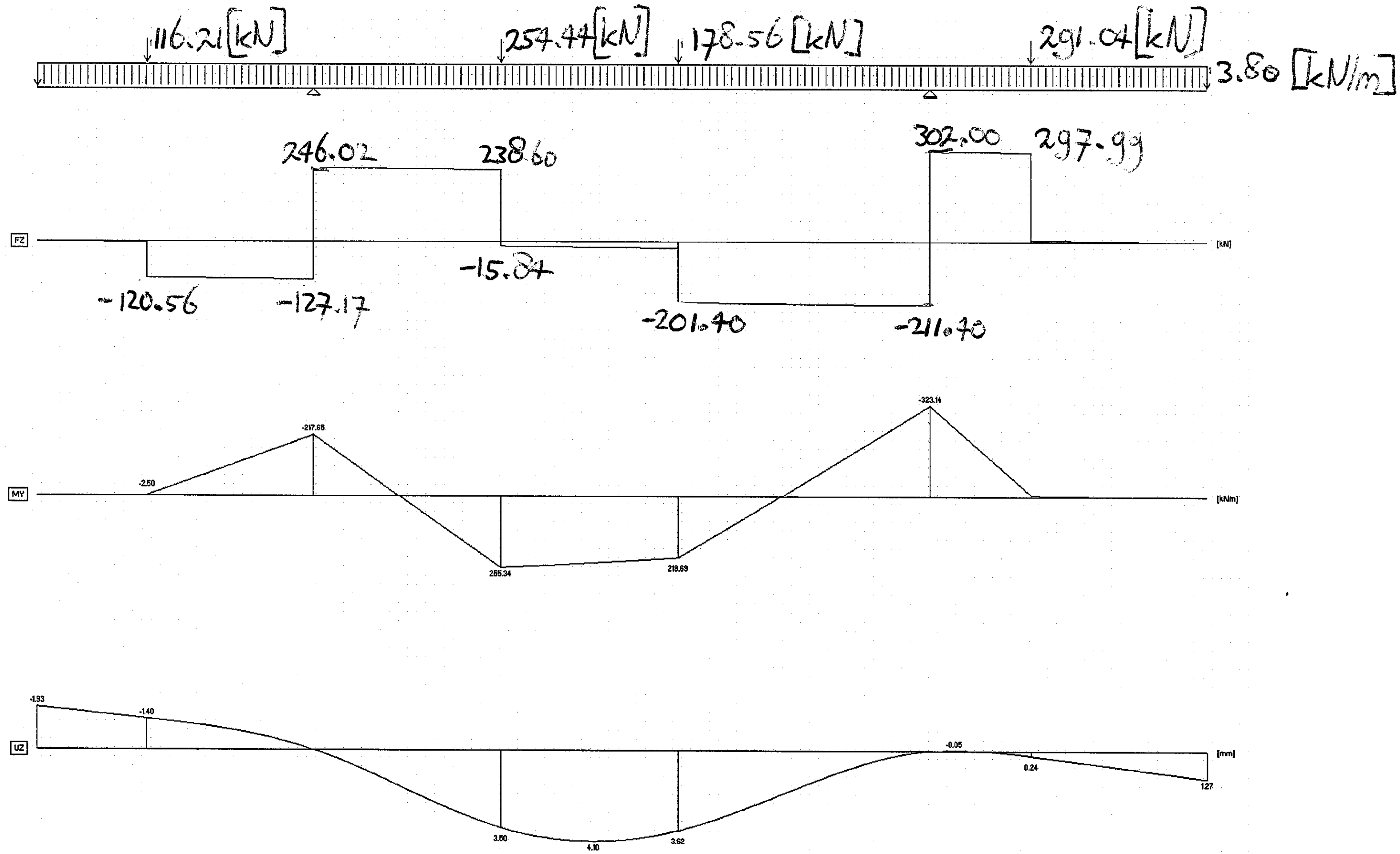
Weld size = 1/4" = 3.71 Kip/in

14" x 3.71 = 51.94 Kip

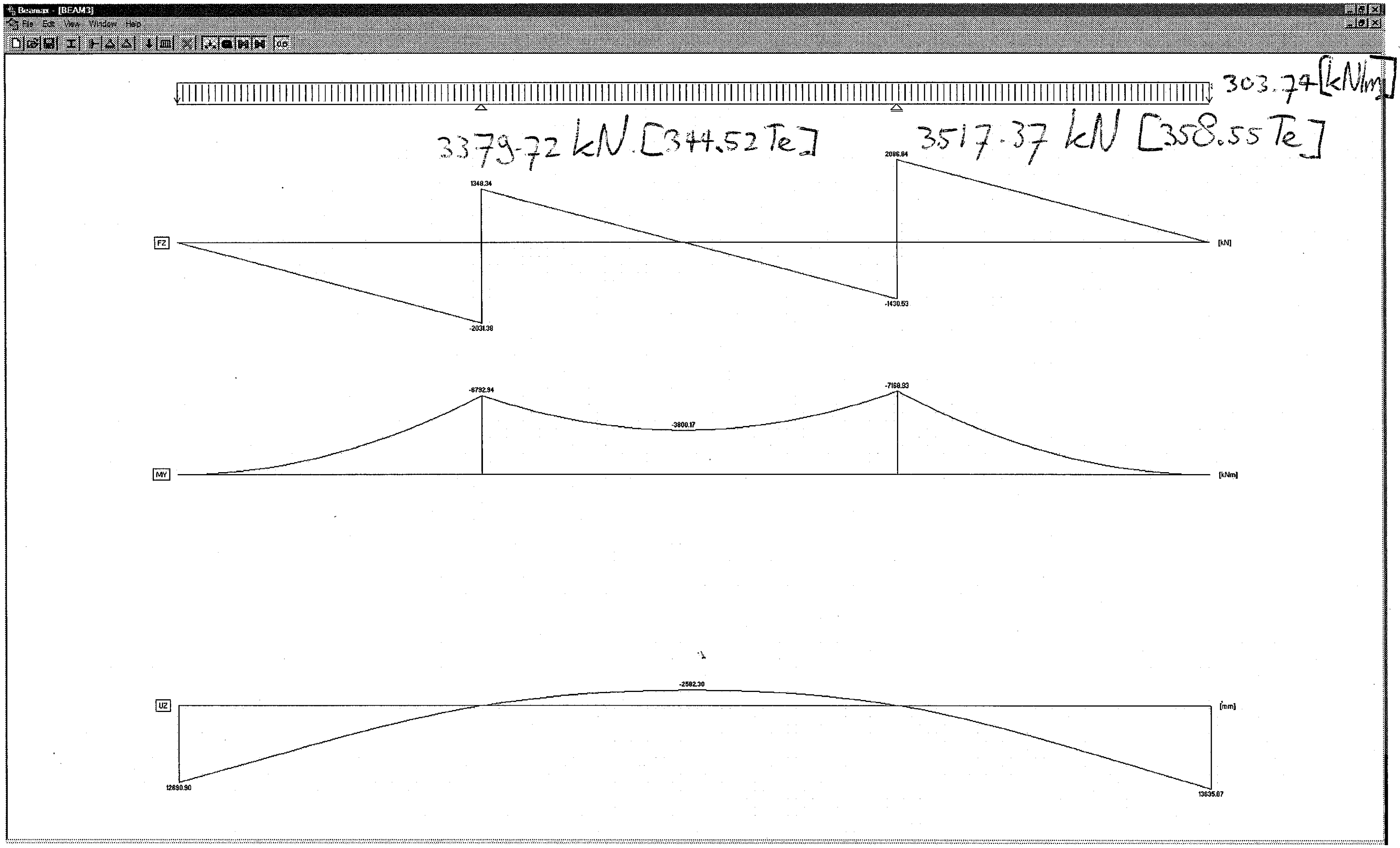
51.94 Kip > 18 Kip

Shear area = 4" x 6" = 24 in^2

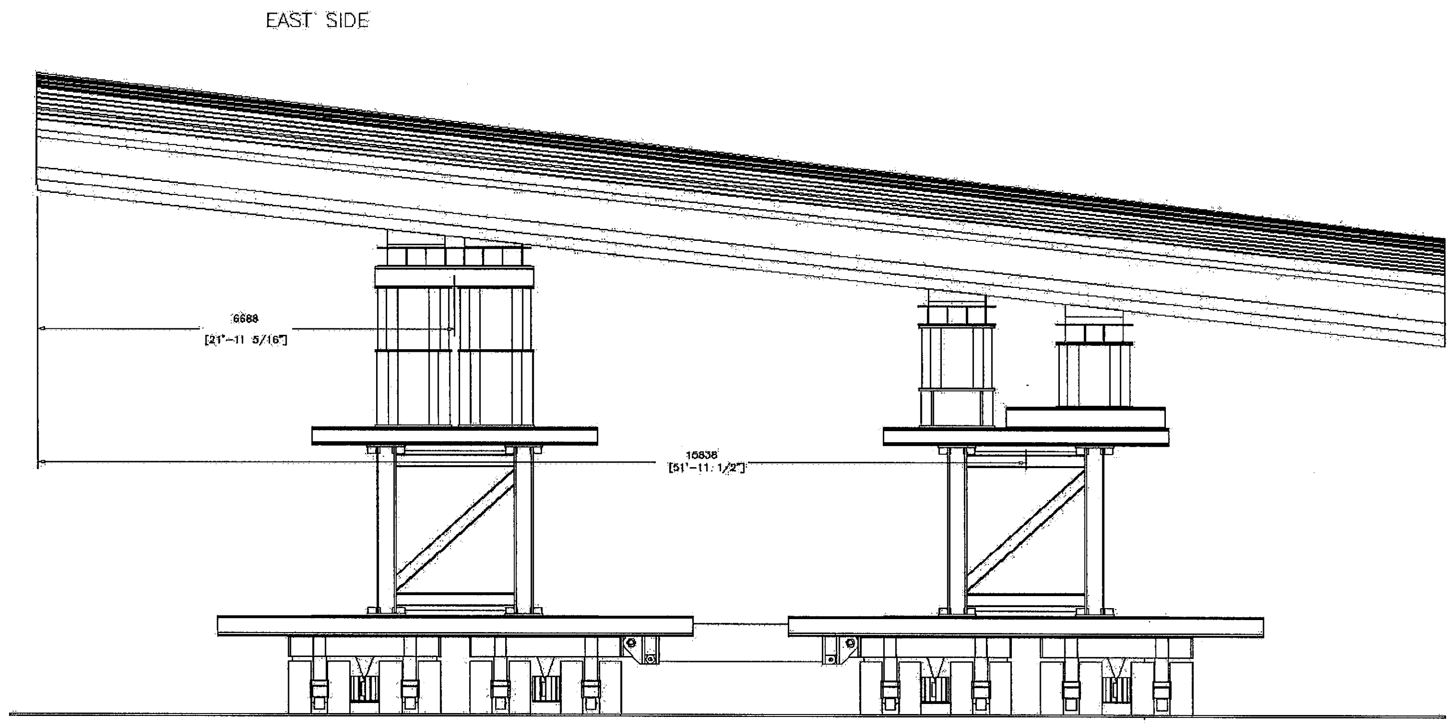
= 18 Kip / 24 in^2 = 750 psi ✓



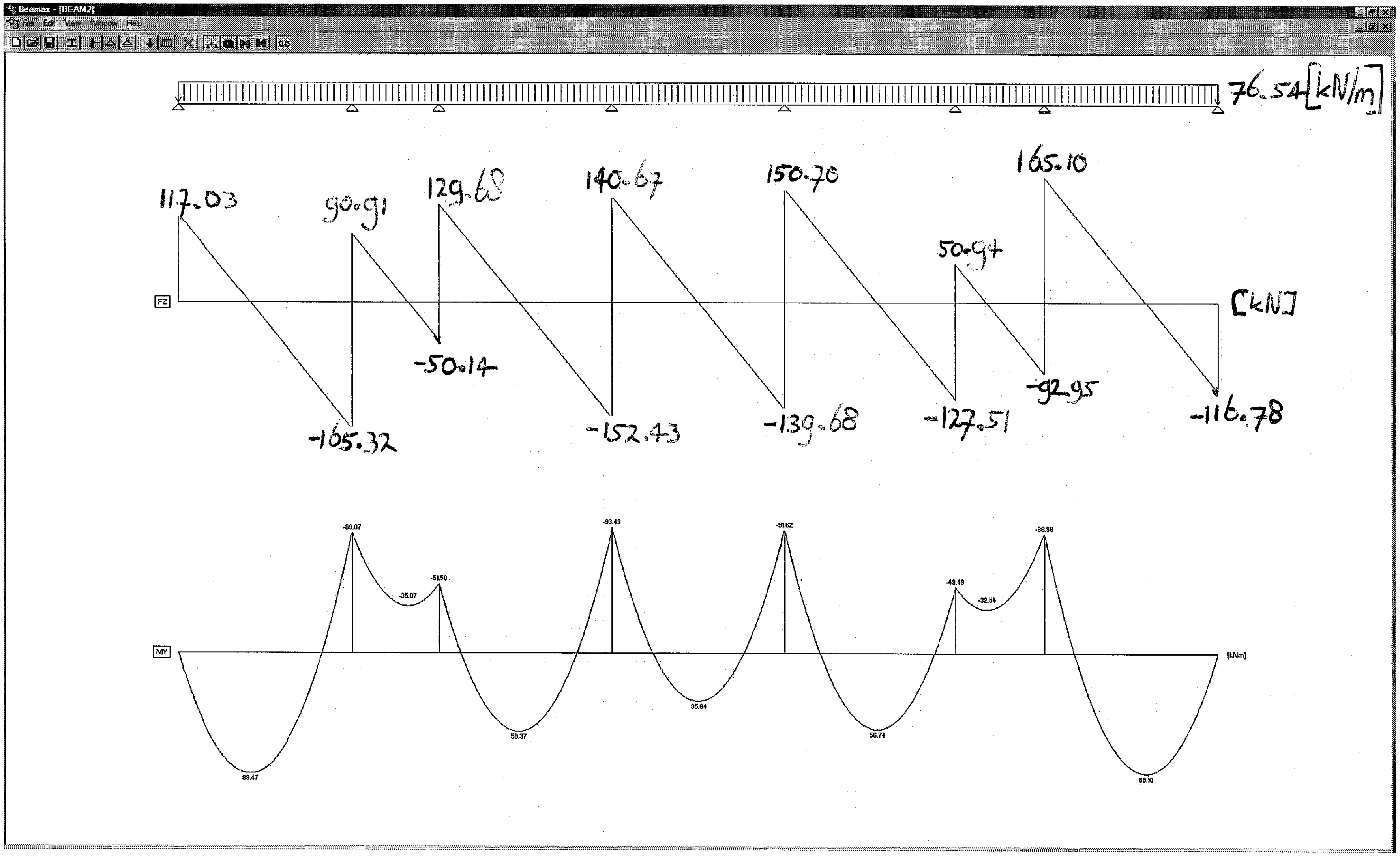
LOADINGS IN SUPPORTS UNDER 40' STEEL MAT (HIGH SIDE WEST BRIDGE)



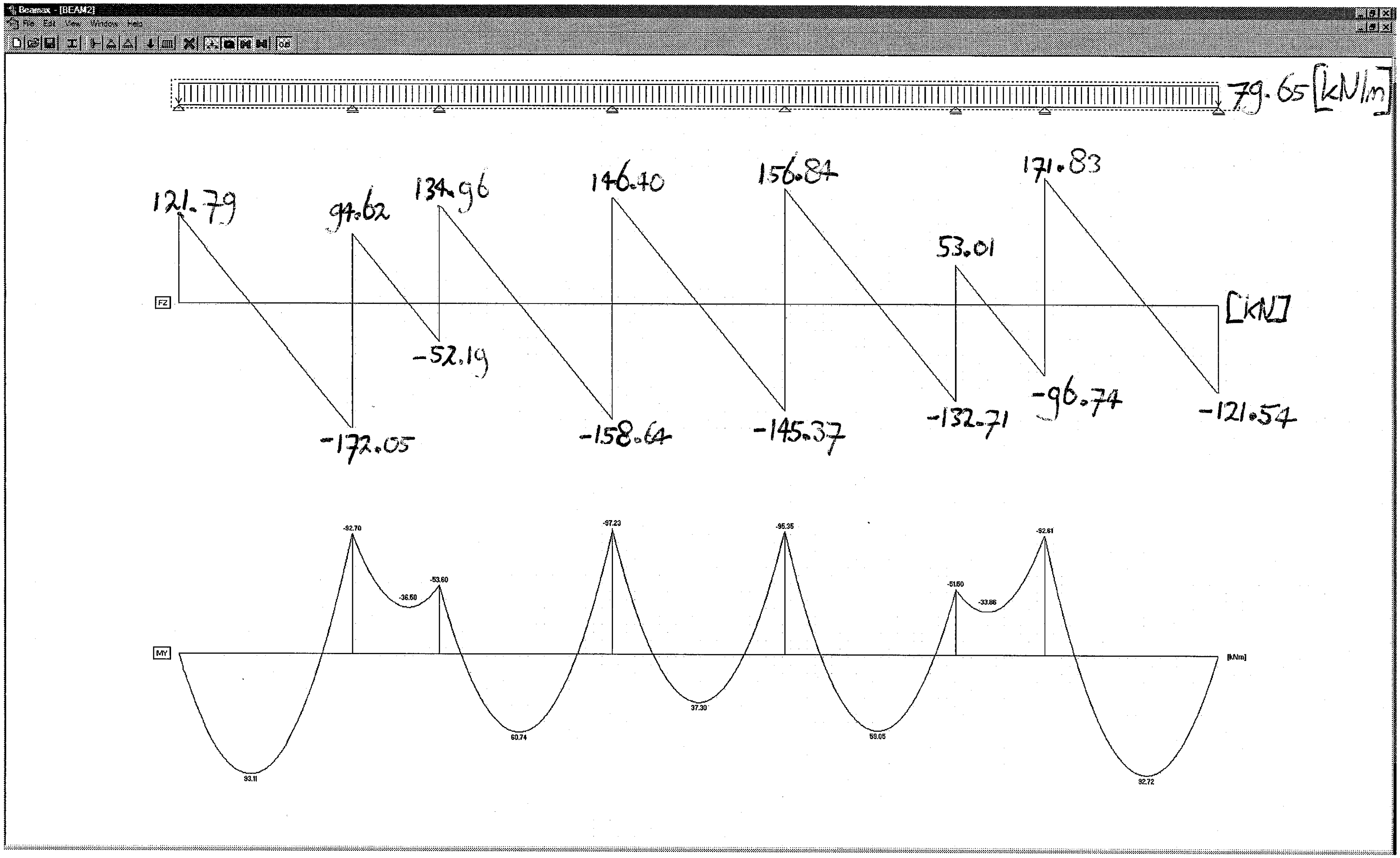
LOADINGS IN BLOCKING FOR EAST SIDE OF BRIDGE
SEE END VIEW OF TRANSPORT IN PICTURE BELOW



LOCATION OF BLOCKING
NOTE THAT DIMENSIONS ARE TAKEN FROM CENTER BETWEEN SETS OF BLOCKING AS THE LOADINGS IN THE BLOCKING ARE EQUAL DUE TO TRAILER HYDRAULICS

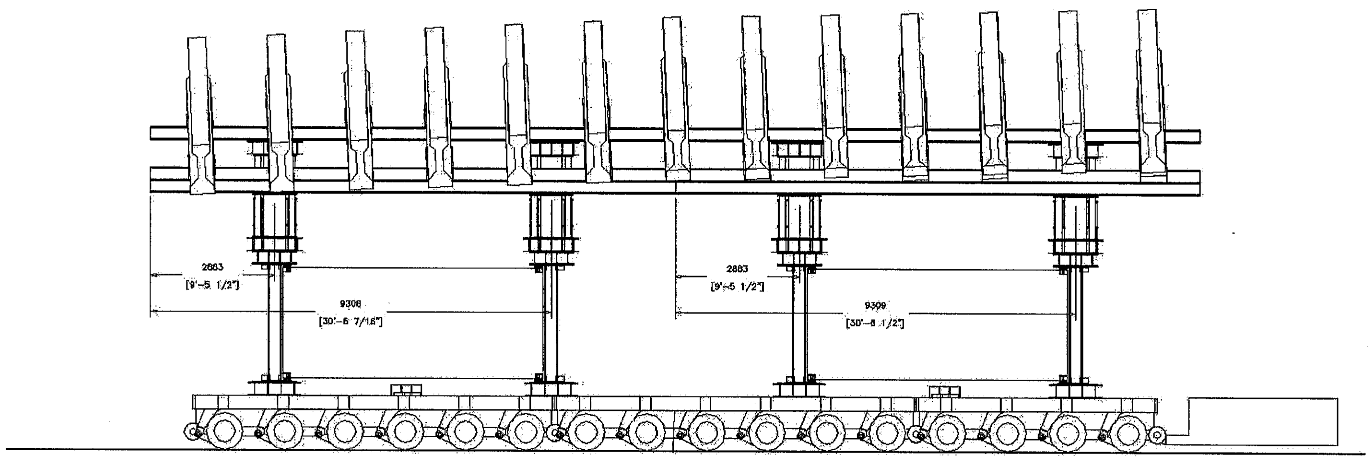


APPROXIMATE WEIGHT DISTRIBUTION OVER LENGTH OF BRIDGE FOR HIGH SIDE OF EAST SIDE BRIDGE (LEFT BLOCKING IN END VIEW)



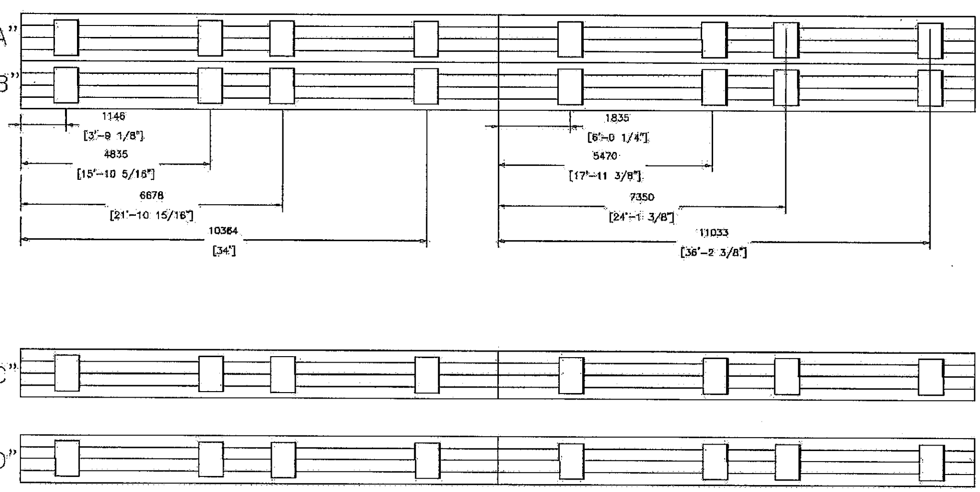
APPROXIMATE WEIGHT DISTRIBUTION OVER LENGTH OF BRIDGE FOR LOW SIDE OF EAST SIDE BRIDGE (RIGHT BLOCKING IN END VIEW)

EAST SIDE

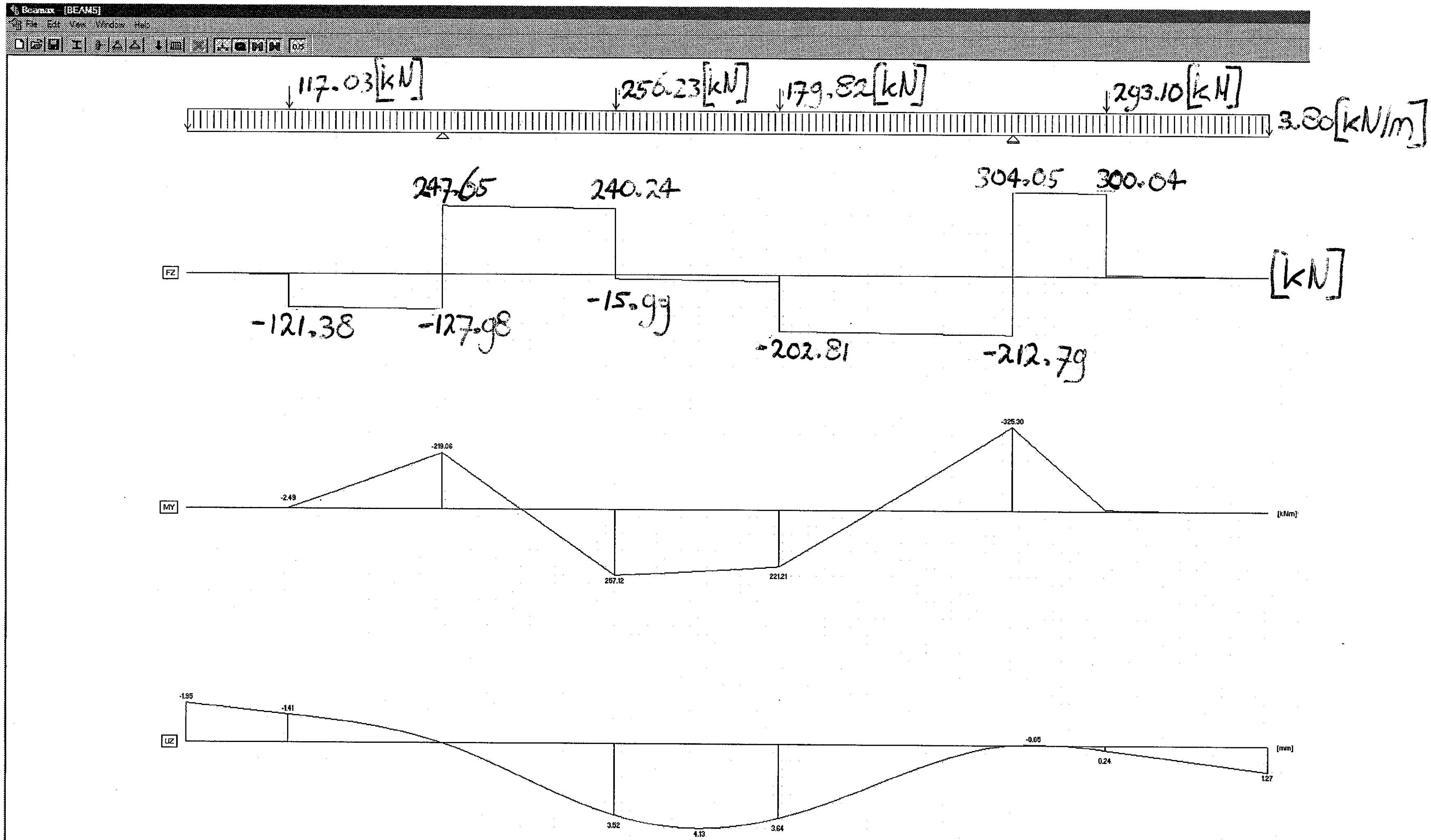


EAST SIDE

ROW "A"
ROW "B"
ROW "C"
ROW "D"



6



LOADINGS IN SUPPORTS UNDER 40' STEEL MAT (HIGH SIDE LEFT MAT)

MAMMOET

Client:	*RALPH L. WADSWORTH*
Project name:	*UTAH*
Project No:	*0010024914-P038*
Item name:	*Strength calculation 40' mat*
Date:	*06/10/2007*
Editor:	*Jack Tol*

Length Ramp:	12192	[mm]	
W(x) Ramp:	5761692	[mm^3]	4 x w12x65
I(x) Ramp:	887405399	[mm^4]	
A(body) Ramp:	28155	[mm^2]	
Weight Ramp:	387	[kg/m]	

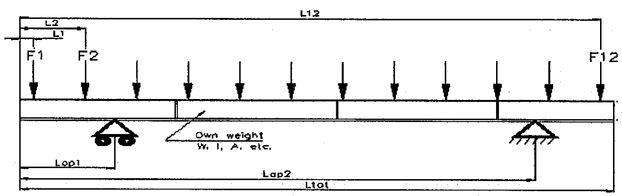
Safety factor v:	1.1		
(Safety additional to AISC safety)			
Allowable Yield stress fy:	345	[N/mm²]	Grade 50

Length till first layup:	2883	[mm]
Length till second layup:	9308	[mm]

Governing UC = 0.28

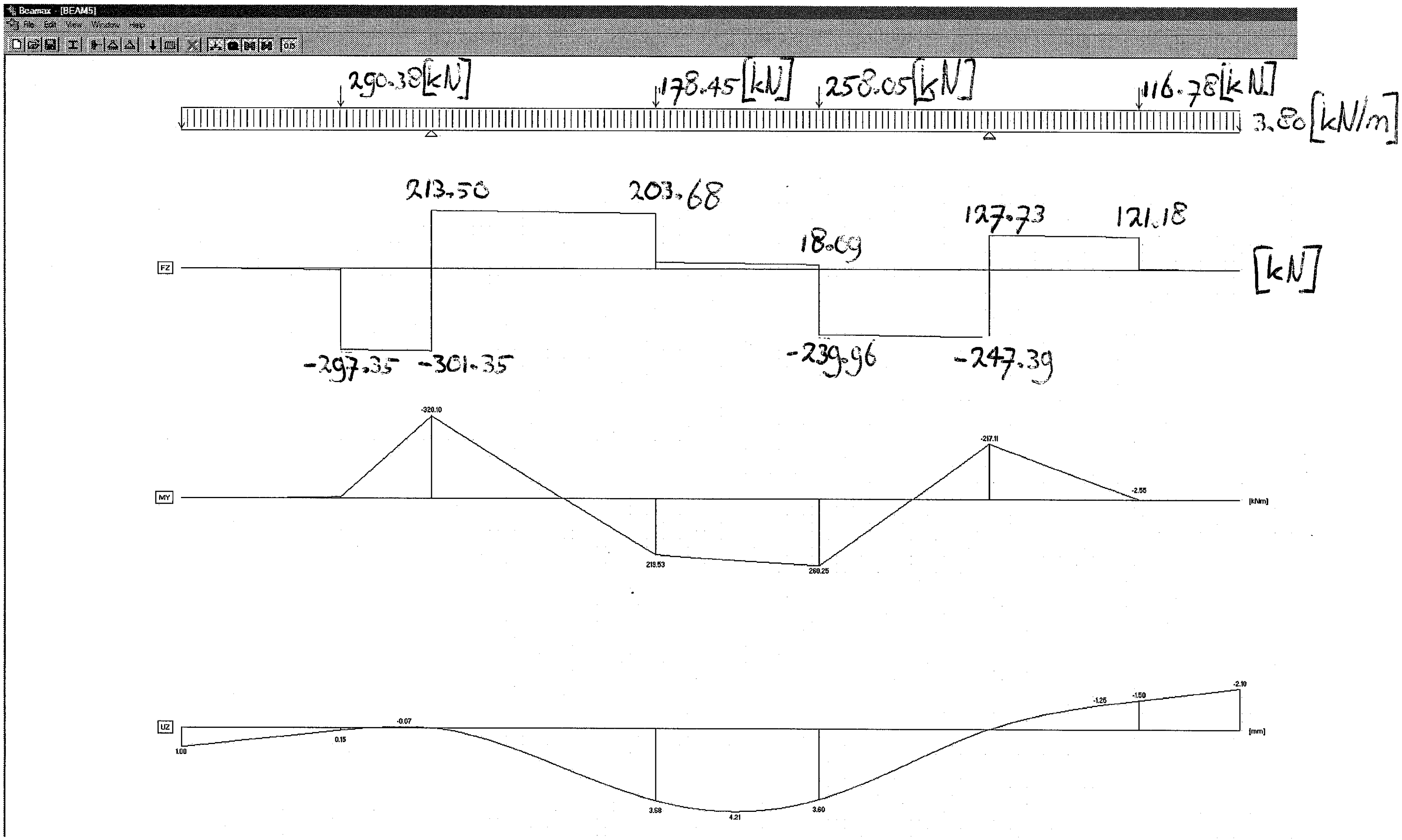
	[X]		Load:		
Length till 1st load:	1146	[mm]	11.93	[ton]	26,300 lbs
Length till 2nd load:	4835	[mm]	26.12	[ton]	57,582 lbs
Length till 3rd load:	6678	[mm]	18.33	[ton]	40,411 lbs
Length till 4th load:	10364	[mm]	29.88	[ton]	65,868 lbs
Length till 5th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 6th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 7th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 8th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 9th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 10th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 11th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 12th load:	0	[mm]	0.00	[ton]	0 lbs

Reaction force "A":	38	[ton]					
Reaction force "B":	53	[ton]					
Max. deflection:	4	[mm]					
Actual bending stress fb:	64	[N/mm²]	< 0.66*fy =	228 [N/mm²]	OK	U.C.=	0.28
Actual shear stress fs	12	[N/mm²]	< 0.4*fy =	138 [N/mm²]	OK	U.C.=	0.09



40' STEEL MAT CHECK FOR HIGH SIDE LEFT MAT

8



LOADINGS IN SUPPORTS UNDER 40' STEEL MAT (HIGH SIDE RIGHT MAT)

VAN SEUMEREN GROUP

MAMMOET

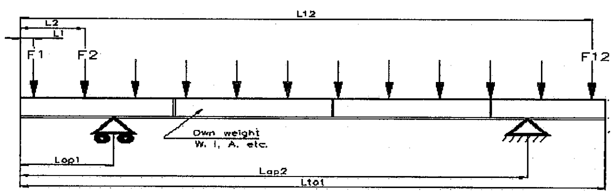
Client:	*RALPH L. WADSWORTH*
Project name:	*UTAH*
Project No:	*0010024814-P038*
Item name:	*Strength calculation 40' mat*
Date:	*06/18/2007*
Editor:	*Jack Tol*

Length Ramp:	12192	[mm]	
W(x) Ramp:	5761692	[mm^3]	4 x w12x65
I(x) Ramp:	837405399	[mm^4]	
A(body) Ramp:	28155	[mm^2]	
Weight Ramp:	387	[kg/m]	
Safety factor v:	1.1		
(Safety additional to AISC safety)			
Allowable Yield stress fy:	345	[N/mm²]	Grade 50
Length till first layup:	2883	[mm]	
Length till second layup:	9309	[mm]	

Governing UC = 0.28

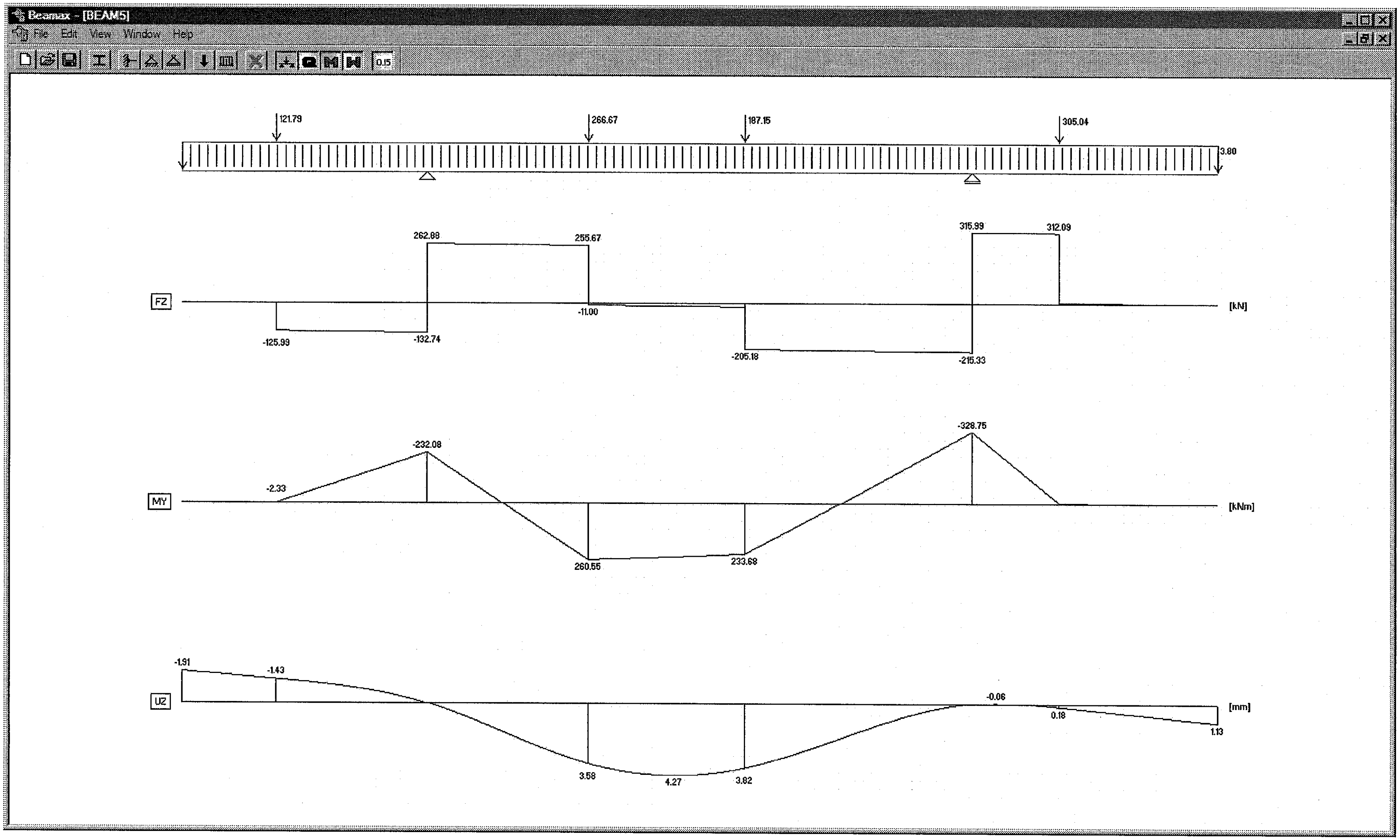
	[X]		Load:		
Length till 1st load:	1836	[mm]	29.60	[ton]	65,256 lbs
Length till 2nd load:	5470	[mm]	18.19	[ton]	40,103 lbs
Length till 3rd load:	7350	[mm]	26.30	[ton]	57,991 lbs
Length till 4th load:	11033	[mm]	11.90	[ton]	26,244 lbs
Length till 5th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 6th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 7th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 8th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 9th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 10th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 11th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 12th load:	0	[mm]	0.00	[ton]	0 lbs

Reaction force "A":	52	[ton]					
Reaction force "B":	38	[ton]					
Max. deflection:	4	[mm]					
Actual bending stress fb:	63	[N/mm²]	< 0.66*fy =	228 [N/mm²]	OK	U.C.=	0.28
Actual shear stress fs	12	[N/mm²]	< 0.4*fy =	138 [N/mm²]	OK	U.C.=	0.09



40' STEEL MAT CHECK FOR HIGH SIDE RIGHT MAT

10



LOADINGS IN SUPPORTS UNDER 40' STEEL MAT (LOW SIDE LEFT MAT)

11

MAMMOET

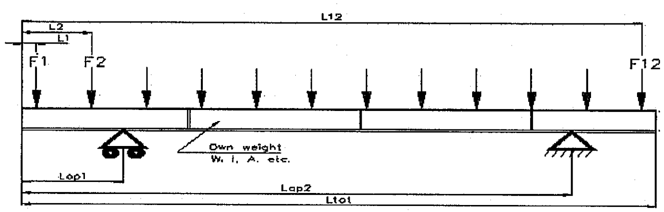
Client:	*RALPH L. WADSWORTH*
Project name:	*UTAH*
Project No:	*0010024914-P038*
Item name:	*Strength calculation 40' mat*
Date:	*06/10/2007*
Editor:	*Jack Tol*

Length Ramp:	12192	[mm]	
W(x) Ramp:	5761692	[mm^3]	4 x w12x65
I(x) Ramp:	887405399	[mm^4]	
A(body) Ramp:	28155	[mm^2]	
Weight Ramp:	387	[kg/m]	
Safety factor v:	1.1		
(Safety additional to AISC safety)			
Allowable Yield stress fy:	345	[N/mm²]	Grade 50
Length till first layup:	2883	[mm]	
Length till second layup:	9309	[mm]	

Governing UC = 0.29

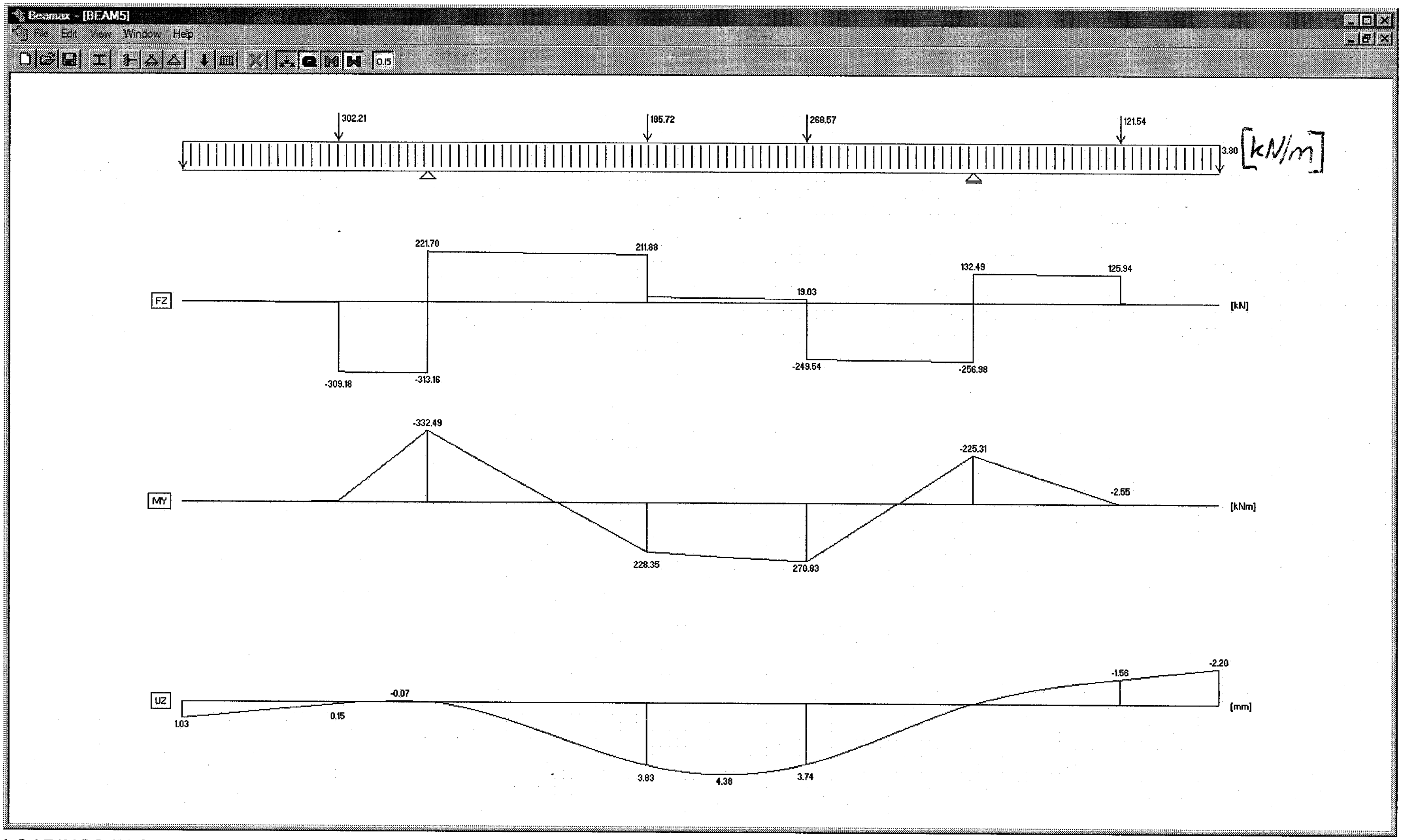
	[X]		Load:		
Length till 1st load:	1146	[mm]	12.41	[ton]	27,370 lbs
Length till 2nd load:	4835	[mm]	27.18	[ton]	59,928 lbs
Length till 3rd load:	6676	[mm]	19.07	[ton]	42,047 lbs
Length till 4th load:	10364	[mm]	31.09	[ton]	68,551 lbs
Length till 5th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 6th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 7th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 8th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 9th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 10th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 11th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 12th load:	0	[mm]	0.00	[ton]	0 lbs

Reaction force "A":	40	[ton]					
Reaction force "B":	55	[ton]					
Max. deflection:	4	[mm]					
Actual bending stress fb:	66	[N/mm²]	< 0.66*fy =	228 [N/mm²]	OK	U.C.=	0.29
Actual shear stress fs	12	[N/mm²]	< 0.4*fy =	138 [N/mm²]	OK	U.C.=	0.09



40' STEEL MAT CHECK FOR LOW SIDE LEFT MAT

12



LOADINGS IN SUPPORTS UNDER 40' STEEL MAT (LOW SIDE RIGH MAT)

MAMMOET

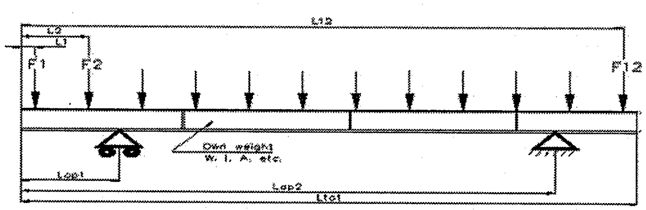
Client:	*RALPH L. WADSWORTH*
Project name:	*UTAH*
Project No:	*0010024914-P038*
Item name:	*Strength calculation 40' mat*
Date:	*06/10/2007*
Editor:	*Jack Tol*

Length Ramp:	12192	[mm]	
W(x) Ramp:	5761692	[mm^3]	4 x w12x65
I(x) Ramp:	887405399	[mm^4]	
A(body) Ramp:	28155	[mm^2]	
Weight Ramp:	387	[kg/m]	
Safety factor v:	1.1		
(Safety additional to AISC safety)			
Allowable Yield stress fy:	345	[N/mm²]	Grade 50
Length till first layup:	2883	[mm]	
Length till second layup:	9309	[mm]	

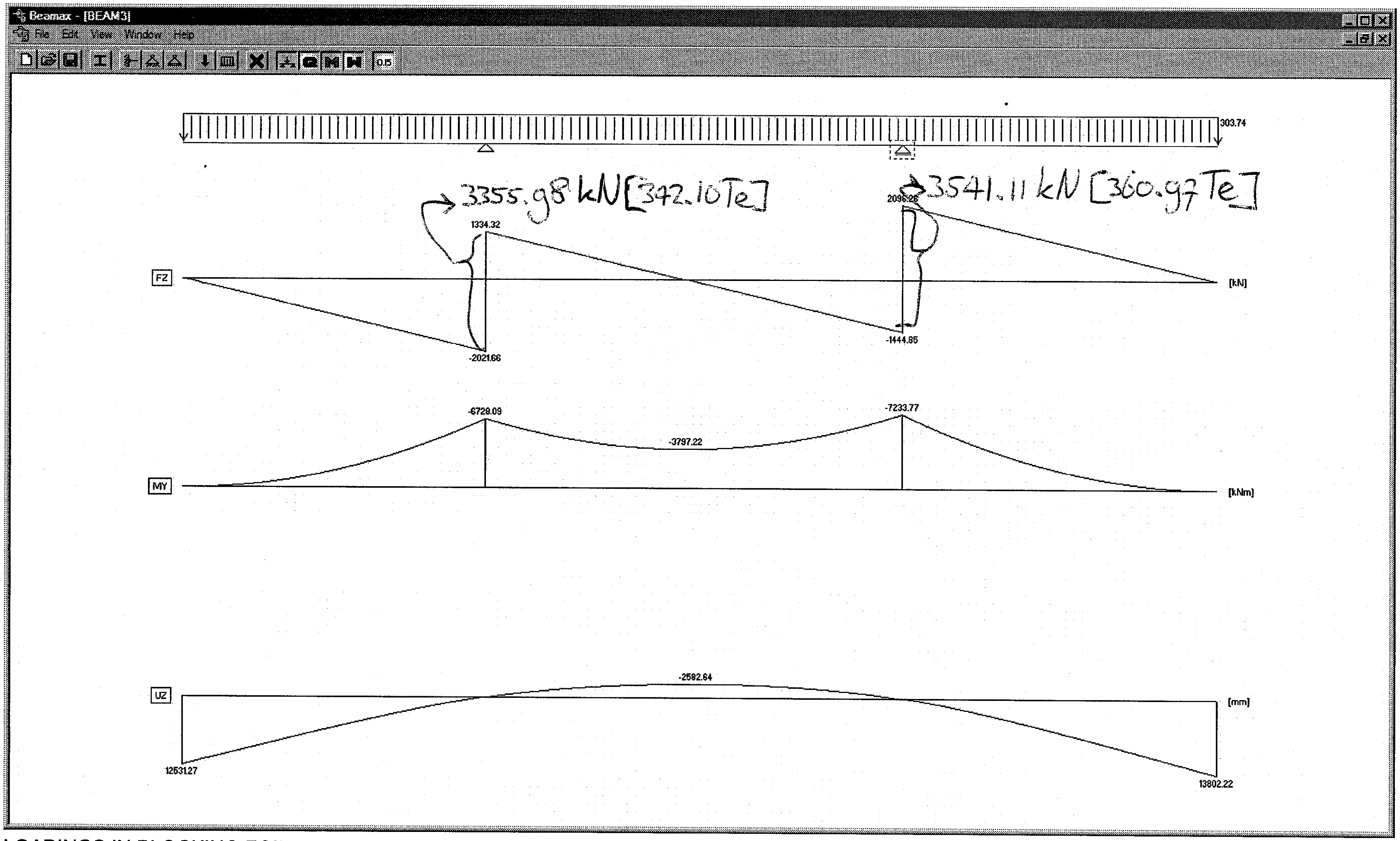
Governing UC = 0.29

	[X]		Load:		
Length till 1st load:	1835	[mm]	30.81	[ton]	67,914 lbs
Length till 2nd load:	5470	[mm]	18.93	[ton]	41,737 lbs
Length till 3rd load:	7360	[mm]	27.38	[ton]	60,355 lbs
Length till 4th load:	11033	[mm]	12.39	[ton]	27,313 lbs
Length till 5th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 6th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 7th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 8th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 9th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 10th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 11th load:	0	[mm]	0.00	[ton]	0 lbs
Length till 12th load:	0	[mm]	0.00	[ton]	0 lbs

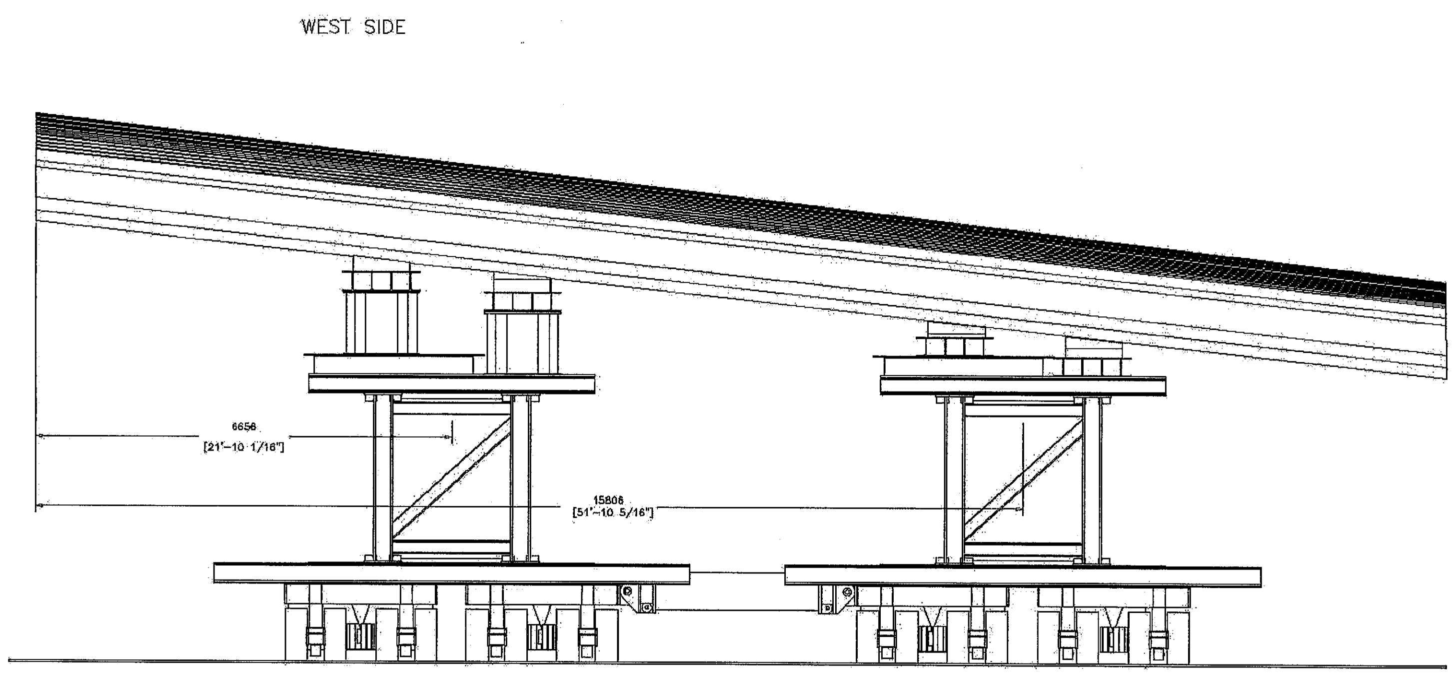
Reaction force "A":	55	[ton]					
Reaction force "B":	40	[ton]					
Max. deflection:	4	[mm]					
Actual bending stress fb:	65	[N/mm²]	< 0.66*fy =	228 [N/mm²]	OK	U.C.=	0.29
Actual shear stress fs	12	[N/mm²]	< 0.4*fy =	138 [N/mm²]	OK	U.C.=	0.09



40' STEEL MAT CHECK FOR LOW SIDE RIGHT MAT

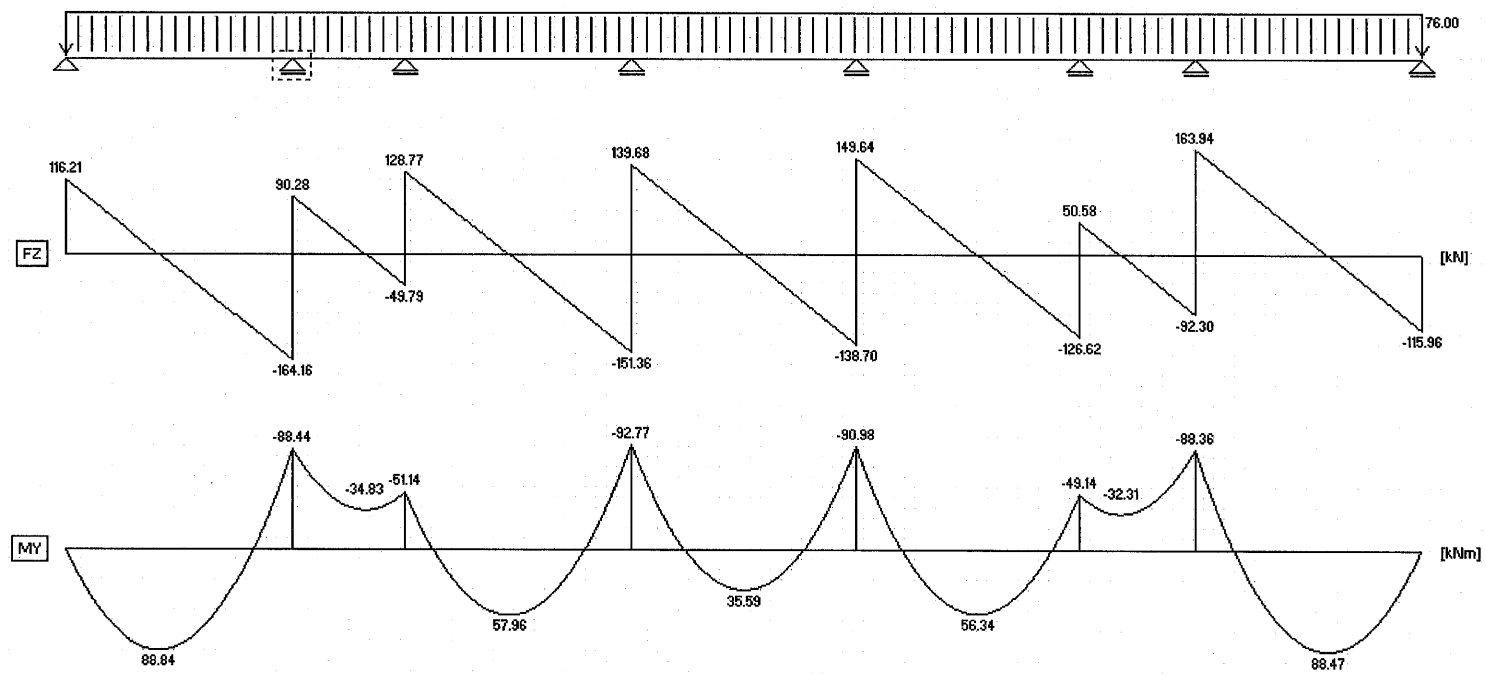


LOADINGS IN BLOCKING FOR WEST SIDE OF BRIDGE
SEE ENDVIEW OF TRANSPORT IN PICTURE ON NEXT PAGE



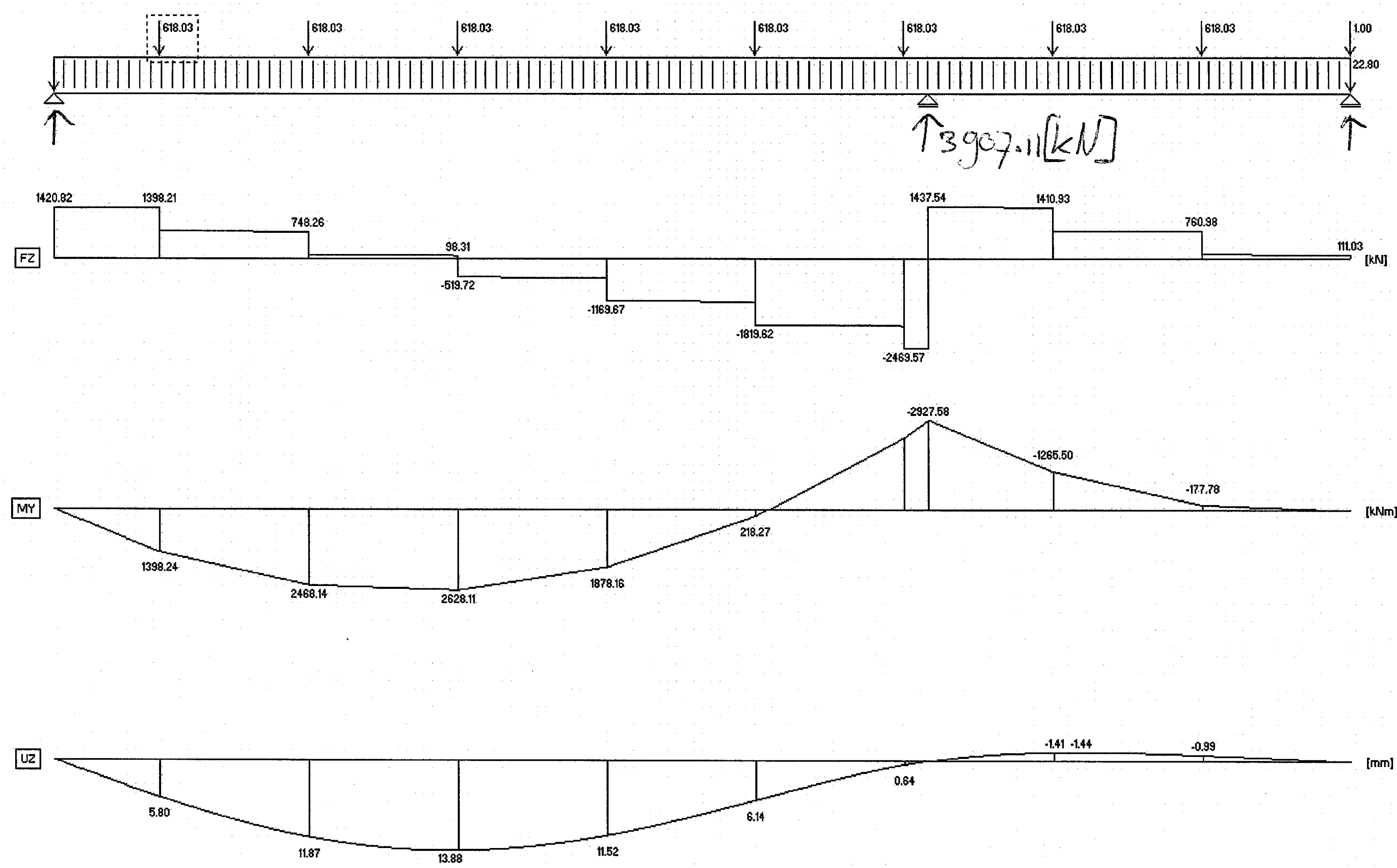
LOCATION OF BLOCKING FOR WEST SIDE

NOTE THAT DIMENSIONS ARE TAKEN FROM CENTER BETWEEN SETS OF BLOCKING AS THE LOADINGS IN THE BLOCKING ARE EQUAL DUE TO TRAILER HYDRAULICS



APPROXIMATE WEIGHT DISTRIBUTION OVER LENGTH OF BRIDGE FOR HIGH SIDE OF WEST SIDE BRIGE (LEFT BLOCKING IN ENDVIEW)

40' ramp calc.



618.03
618.03
618.03
618.03
618.03
618.03
618.03
618.03
1.00
22.80
3907.11 [kN]
FZ
1420.82
1398.21
748.26
98.31
-519.72
-1169.67
-1819.62
-2469.57
1437.54
1410.93
760.98
111.03
[kN]
MY
1398.24
2468.14
2628.11
1878.16
218.27
-2927.58
-1265.50
-177.78
[kNm]
UZ
5.80
11.87
13.88
11.52
6.14
0.64
-1.41 -1.44
-0.99
[mm]

0010024914 - C06-00

Stability calculation blocking above container jacking frames.

- stability over longitudinal direction (travel direction).
  The high side on the East Section is worst case situation

  total side load on bridge is caused by 4% slope in the road & additional 5% impact factor as a safety factor

Analyzed is a 40' section.

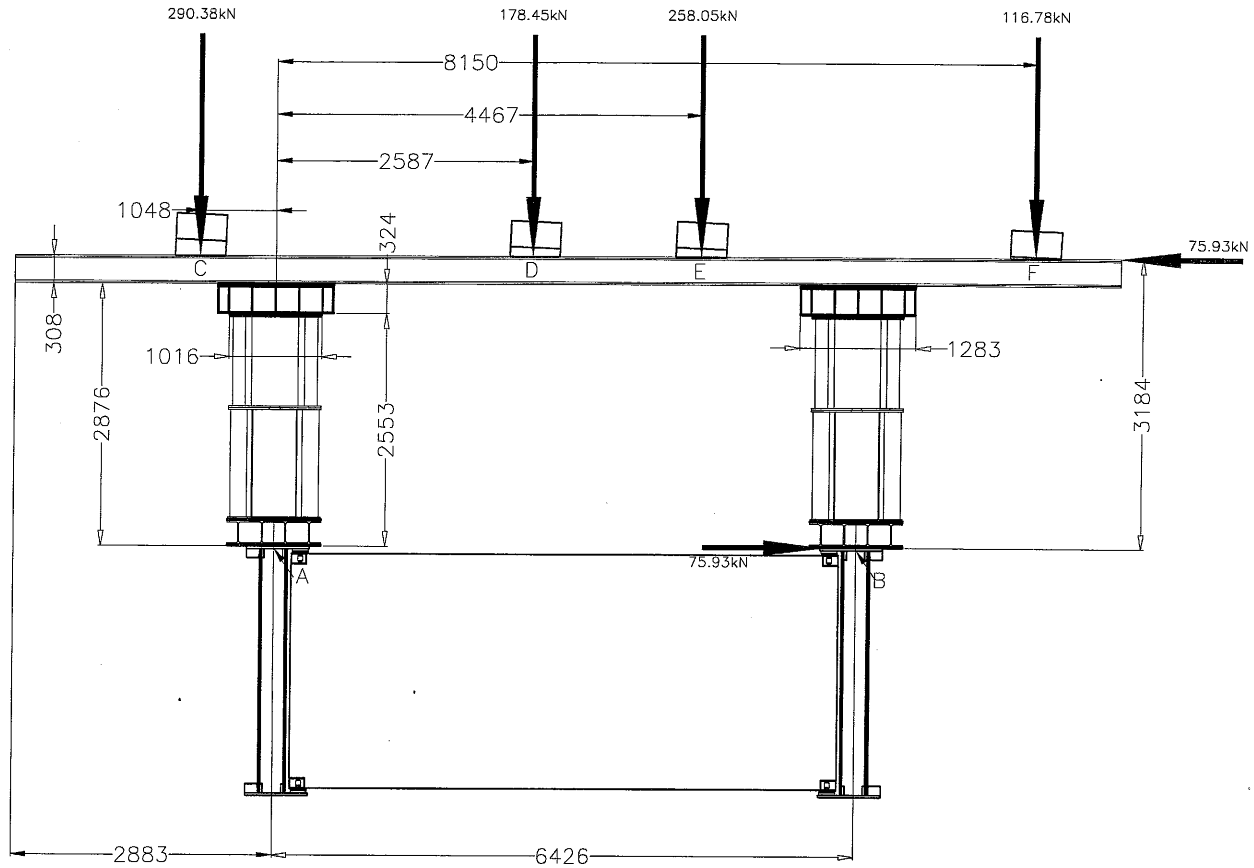
Total bridge load $= 290.38 + 178.45 + 258.05 + 116.78$
$= 843.66\ kN \triangleq 189.6\ kip.$

Total side load on 40' section $= (0.04 + 0.05) \times 843.66$
$= 75.93\ kN \triangleq 17.1\ kip.$

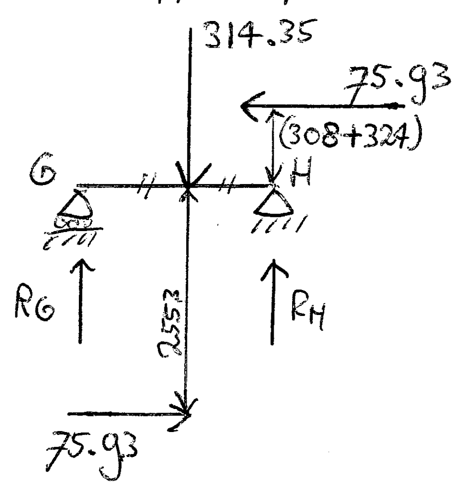
Reaction force RA & RB:

$\Sigma M_A = 0 \Rightarrow 75.93 \times 3184 + 290.38 \times 1048 + R_B \times 6426 =$
$178.45 \times 2587 + 258.05 \times 4467 + 116.78 \times 8150$

$R_B = 314.35\ kN \Rightarrow R_A = 529.31\ kN.$



- Local check of connection of jackstand to steel mat. worst case situation is if all horizontal load is being resisted by one support point with the lowest vertical reaction: support B



GH = 1016 mm

$\Sigma M_G = 0 \Rightarrow$

$314.35 \times \frac{1}{2} \times 1016 =$

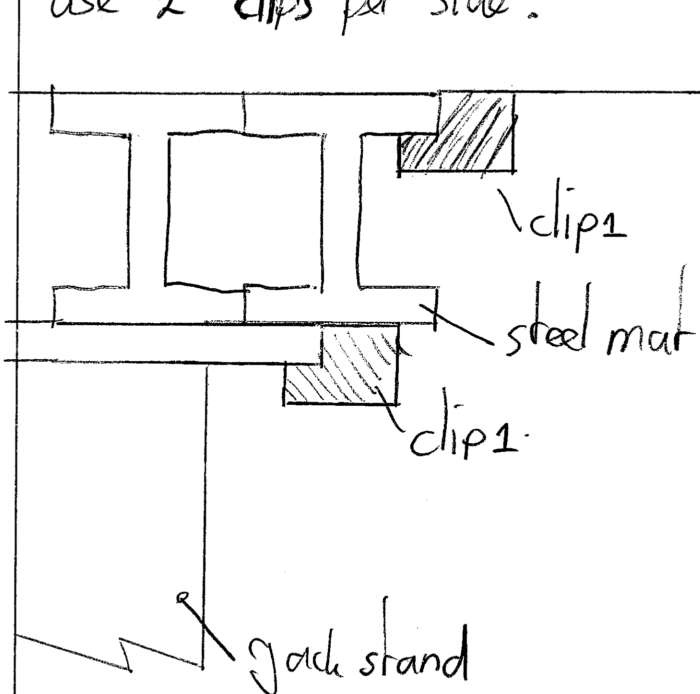
$75.93 \times (2553+308+324) + R_H \times 1016 \Rightarrow$

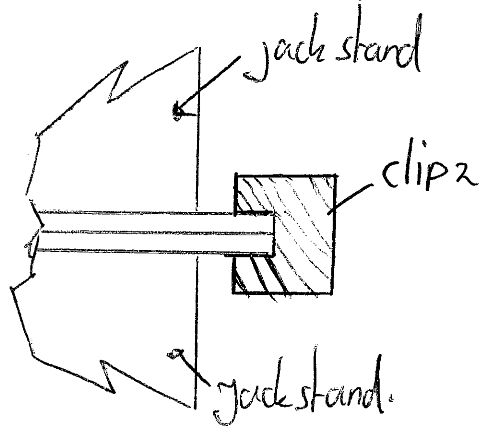
$R_H = -80.85\ kN \triangleq 18.2\ kip$

Conclusion: There is uplift @ H.

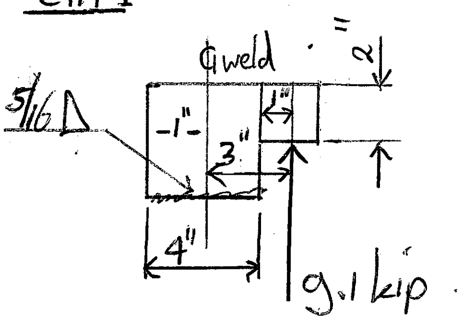
Solution is to "clip" jackstand to steel mat & to clip steel mat to 40' steel mat.

use 2 clips per side.





Clip1



clip is made from A572 Grade 50

$F_y = 50\ ksi$

$F_v = 0.2 \times 50 = 20\ ksi$

$F_b = 0.6 \times 50 = 30\ ksi$

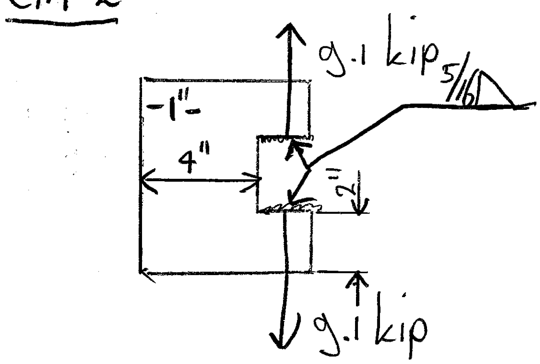
$A_v = 2 \times 1 = 2\ in^2$ $\quad f_v = \frac{9.1}{2} = 4.6\ ksi$

$UC = 0.22$

$S_{strong\ axis} = \frac{1}{6} \times 1 \times 2^2 = \frac{2}{3}\ in^3$

$f_b = \frac{9.1 \times 1}{\frac{2}{3}} = 13.6\ ksi \Rightarrow UC = 0.45$

Clip 2



Per AISC page 4-75.

$\left.\begin{array}{l} al = 3 \\ l = 4 \end{array}\right\} C = 0.551$

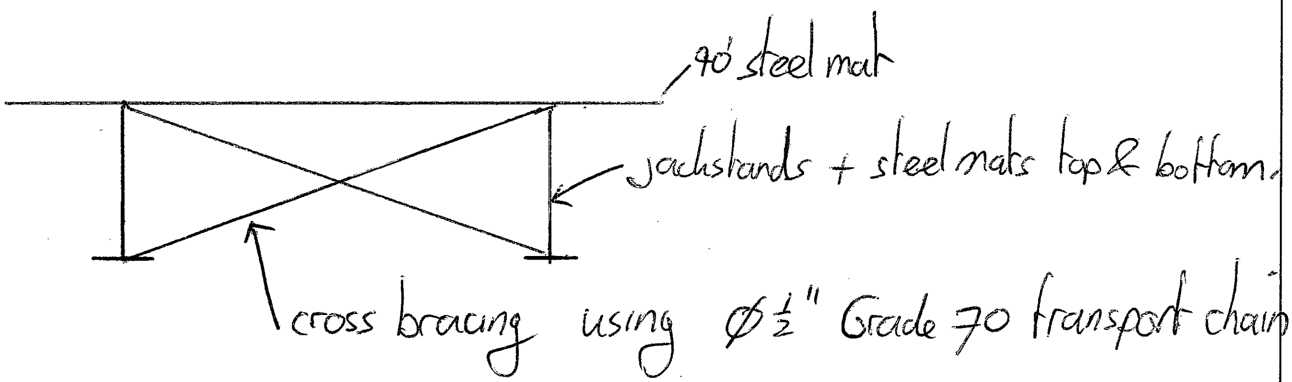
$k = 0$

$D = 5$

$\left.\right\} P = 11.02 > 9.1$

$UC = 0.83$

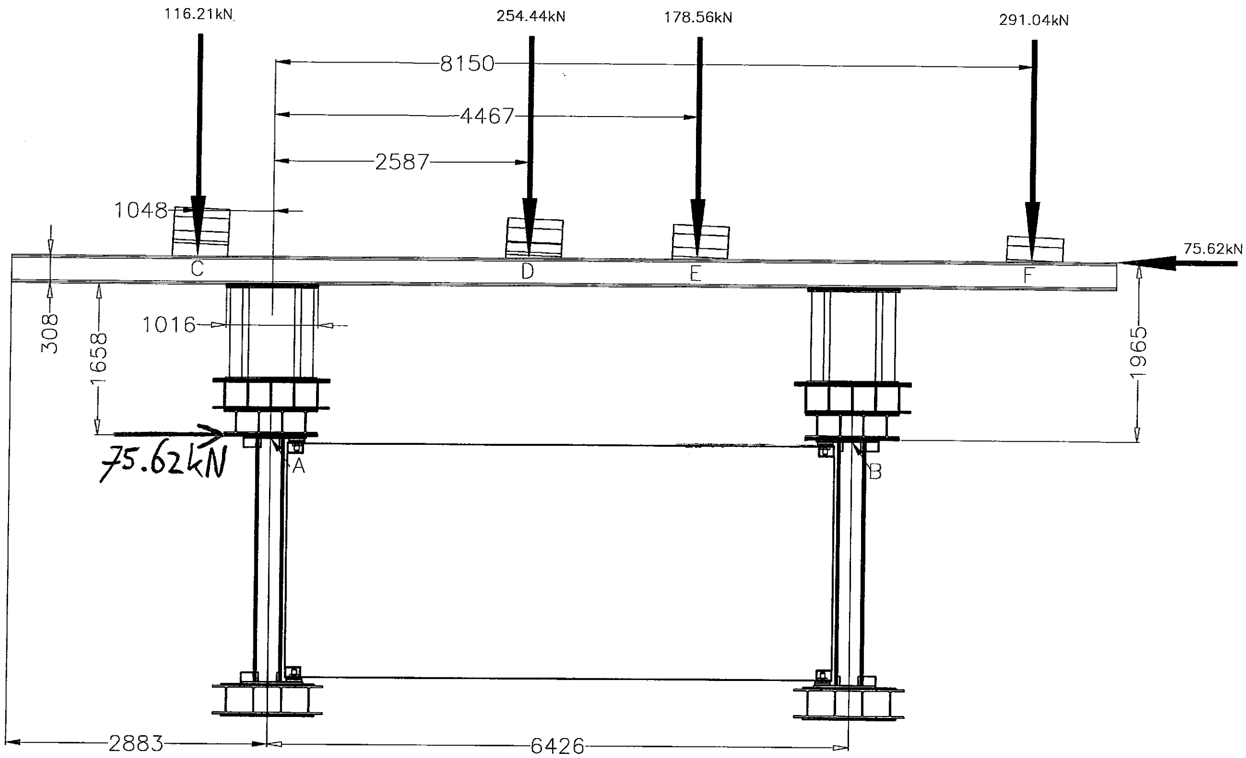
For additional safety $\phi \frac{1}{2}''$ Grade 70 transport chain will be applied diagonally from top of container to bottom of 40' steel mat.



All the blocking above the container jacking frame sits on plywood. The minimum coeficient of friction between plywood & steel = 0.2. The maximum coeficient = 0.8.

No special tiedown of blocking to container is required. Containers + container jacking frames are not required to be chained to the spmt's because the friction between the steel & plywood is higher than the side loads acting on it.

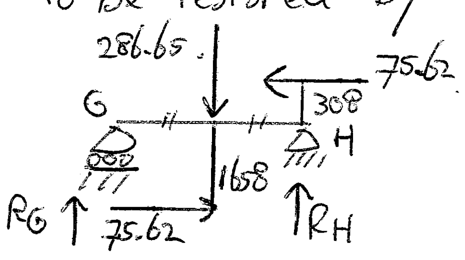
- Stability over longitudinal direction blocking of West side
The high side is analyzed.



$$\Sigma M_A = 0 \Rightarrow 75.62 \times 1965 + 116.21 \times 1048 + R_B \times 6426 =$$
$$254.44 \times 2587 + 178.56 \times 4467 + 291.04 \times 8150$$

$$R_B = 553.60\ kN \Rightarrow R_A = 286.65\ kN.$$

- local check of Jackstand to steel mat. All horizontal loading to be resisted by support A.



$R_H = -3.0\ kN \Rightarrow$ uplift.
Secure jackstand to mat with clips.

The low side of the west side blocking arrangment doesn't need to have clips.

Secure high side with 1 clip per side. use same size clip as for East side bridge.

- Stability of Container + jacking frames in longitudinal Direction (Travel).

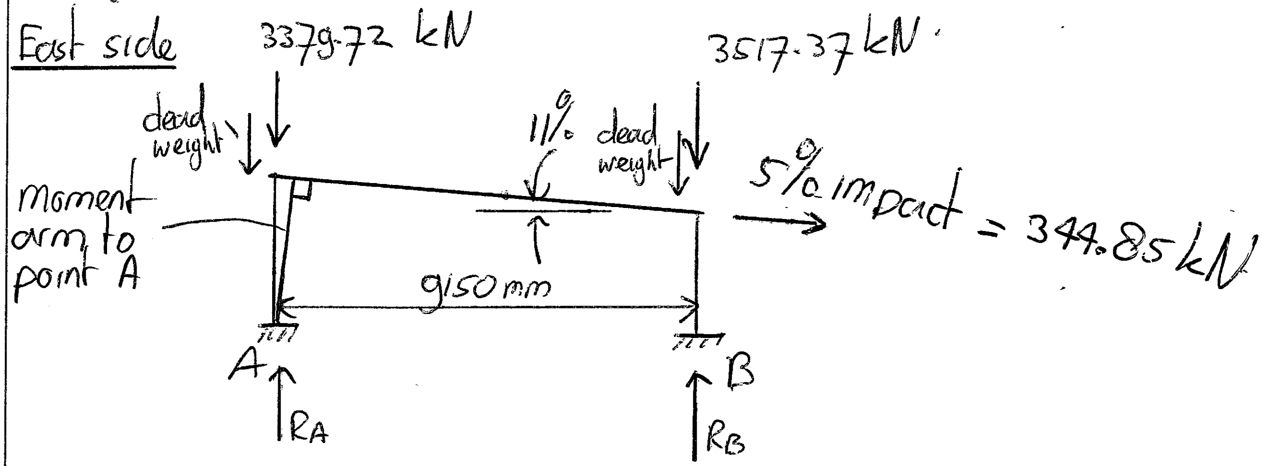
Per ISO standard 1496-1 : 1990 (E) a container is designed to handle 75 kN applied longitudinally at each corner on one side.

The average side load on each corner is > 75 kN. so additional $\phi \frac{1}{2}$" grade 70 transport chain will be used to take the additional loading. As the side load is less than 1 kN higher than allowed by ISO, transport chain is more than adequate for this purpose.

- Transverse stability of East & West Bridge.

AVG. Bridge angle on East side $= 6.28° \triangleq 11\%$
AVG Bridge angle on West side $= 6.42° \triangleq 11.2\%$

East side



avg moment arm $\approx$ 7795 mm. Taken from hydraulic center on trailer to bottom of girder

Avg height of blocking on high side from bottom girder to hydraulic center of trailer = 7845 mm.

AVG height of blocking on low side = 6807 mm

Dead weight of blocking on high side = 148,167 lbs = 659.3 kN
Dead weight of blocking on low side = 139,367 lbs = 620.1 kN

$$\Sigma M_A = 0 \Rightarrow R_B = \frac{9150 \times (3517.37 + 620.1) + 344.85 \times 7845}{9150} \Rightarrow$$

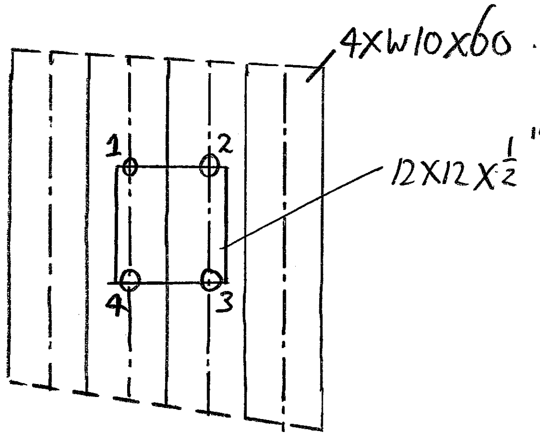
$$R_B = 4433.1\ kN \Rightarrow R_A = 3743.35\ kN$$

No uplift, and trailer has more than adequate capacity.
Note: Stability of West side is better as blocking is lower.

Due to trailer hydraulic group settings there is always the same loading in the supports that are side by side on each trailer.

- Conclusion: Trailer & blocking arrangment is stable in transverse & longitudinal direction.

Check web yielding & web crippling at interface between 15' steel mat & container jacking frame.



each corner has 4 spots where load needs to transfer from steel mat to square tubing. See AISC 9th Edition page 2-31

properties W10X60: $t_f = 0.68''$; $t_w = 0.42''$; $d = 10.22''$; $k = 1\frac{5}{16}$; Grade 50

web yielding: $4 \times 0.66 \times 50 \times 0.42 \times (\frac{1}{2} + 5 \times (1\frac{5}{16})) = 391.5$ kip

web Crippling: $4 \times 67.5 \times 0.42^2 \times \left[1 + 3\left(\frac{\frac{1}{2}}{10.22}\right) \times \left(\frac{0.42}{0.68}\right)^{1.5}\right] \times \sqrt{50 \times \frac{0.68}{0.42}}$

$= 459.1$ kip.

Max. load on jackstand $= 553.6$ kN (West side) $\cong 124.4$ kip

dead weight of jackstand + 40' steel mat + 15' steel mat + blocking $\Rightarrow$
$\cong$ 15 kip.

Total load on corner = 129.4 + 15 $\approx$ 140 kip $\Rightarrow$ UC = 0.36.

- Minimum capacity of jack stands used = 180 us ton. UC = 0.39

Securing bridge to blocking on trailers.

Friction between wood & concrete = 0.62

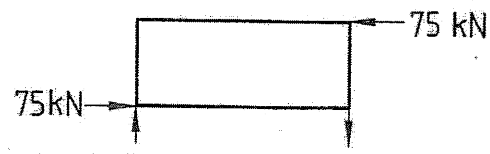
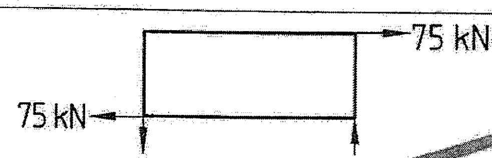
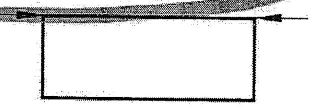
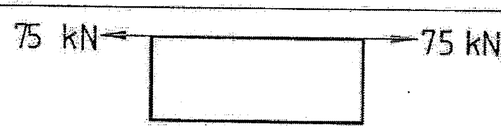
Average angle of bridge = 11.2% = 0.112
impact factor = 5% ≈ 0.05

total horizontal load possible on timber blocking:
0.112 + 0.05 = 0.162 (12.4%)
If a safety factor of 5 on friction is used, then the allowable friction factor between concrete & wood = 0.124.

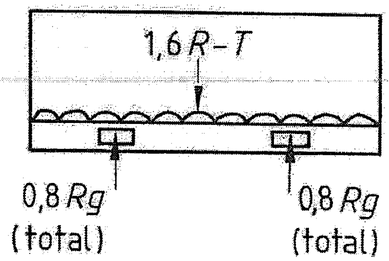
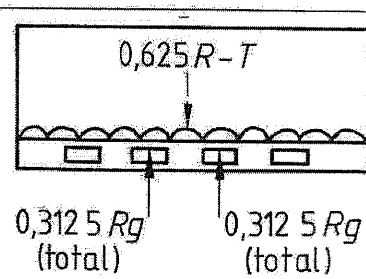
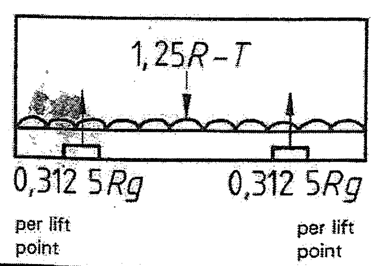
The difference = 0.162 − 0.124 = 0.038 ≈ 3.8%.
This amounts to a total force of 29.45t ≅ 59 kip.

If client provides 4 securing anchors on the low side of the bridge, the load per anchor will be ≈ 15 kip.

Using grade 70 $\phi \frac{1}{2}$" transport chain with a straight pull capacity of 11,300 lbs, doubled up will be sufficient.

Figure No.	End elevations	Side elevations
A.17	Rigidity (longitudinal) Test No. 10 Not applicable to 1D and 1DX containers	
A.18		
A.19	Lashing/securement (This type of loading is inadmissible except as applied in A.3A)	
A.20	Lashing/securement Not applicable to 1D and 1DX containers	

Optional features

Figure No.	End elevations	Side elevations
A.21	Fork-lift pockets Test No. 11 Applicable to 1CC, 1C, 1CX, 1D and 1DX containers when fitted with one set of fork-lift pockets	
A.22	Fork-lift pockets Test No. 11 Applicable to 1CC, 1C and 1CX containers when fitted with a second set of fork-lift pockets	
A.23	Grappler lift Test No. 12 Applicable to all sizes when fitted with grappler arm lift positions	

6.7.3 Requirements

Upon completion of the test, the container shall show neither permanent deformation which will render it unsuitable for use nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

6.8 Test No. 7 — Strength of the roof (where provided)

6.8.1 General

This test shall be carried out to prove the ability of the rigid roof of a container, where fitted, to withstand the loads imposed by persons working on it.

6.8.2 Procedure

A load of 300 kg[1] shall be uniformly distributed over an area of 600 mm × 300 mm[1] located at the weakest area of the rigid roof of the container.

6.8.3 Requirements

Upon completion of the test, the container shall show neither permanent deformation which will render it unsuitable for use nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

6.9 Test No. 8 — Floor strength

6.9.1 General

This test shall be carried out to prove the ability of a container floor to withstand the concentrated dynamic loading imposed during cargo operations involving powered industrial trucks or similar devices.

6.9.2 Procedure

The test shall be performed using a test vehicle equipped with tyres, with an axle load of 5 460 kg[1] [i.e. 2 730 kg[1] on each of two wheels]. It shall be so arranged that all points of contact between each wheel and a flat continuous surface lie within a rectangular envelope measuring 185 mm[1] (in a direction parallel to the axle of the wheel) by 100 mm[1] and that each wheel makes physical contact over an area within this envelope of not more than 142 cm^2[1]. The wheel width shall be nominally 180 mm[1] and the wheel centres shall be nominally 760 mm[1]. The test vehicle shall be manœuvred over the entire floor area of the container. The test shall be made with the container resting on four level supports under its four bottom corner fittings, with its base structure free to deflect.

6.9.3 Requirements

Upon completion of the test, the container shall show neither permanent deformation which will render it unsuitable for use nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

6.10 Test No. 9 — Rigidity (transverse)

6.10.1 General

This test shall be carried out to prove the ability of a container, other than a 1D or a 1DX container, to withstand the transversal racking forces resulting from ship movement.

6.10.2 Procedure

The container in tare condition (T) shall be placed on four level supports, one under each corner fitting, and shall be restrained against lateral and vertical movement by means of anchor devices acting through the bottom apertures of the bottom corner fittings. Lateral restraint shall be provided only at a bottom corner fitting diagonally opposite to and in the same end frame as a top corner fitting to which force is applied. When testing the two end frames separately, vertical restraint shall be applied only at the end frame under test.

Forces of 150 kN[1] shall be applied either separately or simultaneously to each of the top corner fittings on one side of the container in lines parallel both to the base and to the planes of the ends of the container. The forces shall be applied first towards and then away from the top corner fittings.

In the case of a container with identical ends, only one end need be tested. Where an end is not essentially symmetrical about its own vertical centreline, both sides of that end shall be tested.

For allowable deflections under full test loading, see 5.4.

6.10.3 Requirements

Upon completion of the test, the container shall show neither permanent deformation which will render it unsuitable for use nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

6.11 Test No. 10 — Rigidity (longitudinal)

6.11.1 General

This test shall be carried out to prove the ability of a container, other than a 1D or a 1DX container, to withstand the longitudinal racking forces resulting from ship movement.

1) 300 kg = 660 lb
600 mm × 300 mm = 24 in × 12 in
5 460 kg = 12 000 lb
2 730 kg = 6 000 lb
185 mm = 7 1/4 in
100 mm = 4 in
142 cm^2 = 22 in^2
180 mm = 7 in
760 mm = 30 in
150 kN = 33 700 lbf

6.11.2 Procedure

The container in tare condition (T) shall be placed on four level supports, one under each corner fitting, and shall be restrained against longitudinal and vertical movement by means of anchor devices acting through the bottom apertures of the bottom corner fittings. Longitudinal restraint shall be provided only at a bottom corner fitting diagonally opposite to and in the same side frame as a top corner fitting to which force is applied.

Forces of 75 kN[1)] shall be applied either separately or simultaneously to each of the top corner fittings on one end of the container in lines parallel both to the base of the container and to the planes of the sides of the container. The forces shall be applied first towards and then away from the top corner fitting.

In the case of a container with identical sides, only one side need be tested. Where a side is not essentially symmetrical about its own vertical centreline, both ends of that side shall be tested.

For allowable deflections under full test loading, see 5.5.

6.11.3 Requirements

Upon completion of the test, the container shall show neither permanent deformation which will render it unsuitable for use nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

6.12 Test No. 11 — Lifting from fork-lift pockets
(where fitted)

6.12.1 General

This test shall be carried out on any 1CC, 1C, 1CX, 1D or 1DX container which is fitted with fork-lift pockets.

6.12.2 Procedure

6.12.2.1 1CC, 1C, 1CX, 1D or 1DX containers fitted with one set of fork-lift pockets

The container shall have a load uniformly distributed over the floor in such a way that the combined mass of container and test load is equal to 1,6 R and it shall be supported on two horizontal bars, each 200 mm[1)] wide, projecting 1 828 mm ± 3 mm[1)] into the fork-lift pockets, measured from the outside face of the side of the container. The bars shall be centred within the pockets.

The container shall be supported for 5 min and then lowered to the ground.

6.12.2.2 1CC, 1C or 1CX containers fitted with two sets of fork-lift pockets

The test described in 6.12.2.1 shall be applied to the outer pockets.

A second test shall be applied to the (additional) inner pockets. The procedure for this second test shall be as required in 6.12.2.1 except that in this case the combined mass of the container and test load shall be equal to 0,625 R, and the bars shall be placed in the inner pockets.

6.12.3 Requirements

Upon completion of the test, the container shall show neither permanent deformation which will render it unsuitable for use nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

6.13 Test No. 12 — Lifting from the base at grappler arm positions (where fitted)

vervalt; zie amendement 2 (1990)

6.13.1 General

This test shall be carried out on any container which is fitted with fixtures for being lifted by grappler arms or similar devices with lifting positions as detailed in annex D.

6.13.2 Procedure

The container shall have a load uniformly distributed over the floor in such a way that the combined mass of the container and the uniformly distributed test load is equal to 1,25 R, and it shall be supported at the four positions where provision has been made for the equipment envisaged in 6.13.1, over an area of 32 mm × 254 mm[1)] centrally located at each of the four positions, clear of the safety lips.

The container shall be supported for 5 min and then lowered to the ground.

6.13.3 Requirements

Upon completion of the test, the container shall show neither permanent deformation which will render it unsuitable for use nor abnormality which will render it unsuitable for use, and the dimensional requirements affecting handling, securing and interchange shall be satisfied.

1) 75 kN = 16 850 lbf
200 mm = 8 in
1 828 mm ± 3 mm = 72 in ± 1/8 in
32 mm × 254 mm = 1 1/4 in × 10 in